Performance Reporter for OS/390
Capacity Planner Feature
Guide and Reference
Release 5
Fifth Edition (August 2000)

This major revision obsoletes and replaces SH19-4021-03. The major changes are described in the Summary of changes on page xiv. Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

This edition applies to Release 5 Modification Level 0 of Tivoli Performance Reporter for OS/390, Program Number 5695-101, and to all subsequent releases and modifications until otherwise indicated in new editions. Make sure you are using the correct edition for the level of the product. This product was previously known as Enterprise Performance Data Manager/MVS (EPDM).

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About this Book

This book describes how to use Tivoli Performance Reporter for OS/390 to plan for capacity on OS/390 systems. Performance Reporter for OS/390 was previously known as Enterprise Performance Data Manager/ (EPDM).

This book shows you how to install Capacity Planner on the Performance Reporter for OS/390 base system and on an Operating System/2 workstation, and how to use Capacity Planner.

The terms MVS and OS/390 are used interchangeably in the book.

Who should use this book

The Capacity Planner Feature Guide and Reference is for:

- Anyone responsible for capacity planning
- Anyone responsible for installing and implementing Capacity Planner.

How to use this book

This book contains two parts:

- Part I — Guide describes how the product works.
- Part II — Reference contains reference material that you may need occasionally.

Part I — Guide contains the following chapters:

- Chapter 1, “An Introduction to Performance Reporter and Capacity Planner”, is an introduction to Capacity Planner.
- Chapter 2, “Installing Capacity Planner”, shows you how to implement Capacity Planner.
- Chapter 3, “Introduction to Capacity Planning”, introduces you to capacity planning and explains the concepts.

The remainder of Part I — Guide shows you how to use the workstation dialog to do capacity planning:

- Chapter 4, “Managing Data on the Workstation”, is an introduction to the dialog.
- Chapter 5, “Using Capacity Planner” is a practice session that uses the most important features of the dialog.
- Chapter 6, “Using Capacity Planner”, shows you how to make a plan that combines work from more than one system.
- Chapter 7, “Reporting on PR/SM and VM Complexes”, explains how Capacity Planner reports on Processor Resource/System Manager (PR/SM) and VM systems.

Read the first three chapters before using the dialog, then use the dialog as you work through Chapter 4, “Managing Data on the Workstation”, and Chapter 5, “Using Capacity Planner”.

Capacity Planner Feature Guide and Reference
Summary of changes

Changes for the previous edition
The name of the base product has been changed to Tivoli Performance Reporter for OS/390.

This edition is an updated version that replaces the previous edition of the same book. Except for editorial changes, updates to this edition are marked with a vertical bar to the left of the change.

APAR PQ11119 has been incorporated in this edition of the book.

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Where to find more information
Information that will help you as you use Capacity Planner is available in the Performance Reporter library and in related libraries.

Performance Reporter library

BookManager softcopy versions of the Performance Reporter library will be available on CD-ROM in the following collection kits:
- OS/390 Collection, order number SK2T-6700.
- Networking Systems Collection, order number SK2T-6012.

While using any Performance Reporter dialog, you can use the help pull-down to start BookManager to view any of these books.
Administration

Administration Guide

SH19-6816

Reporting dialogs

Guide to the Reporting Dialog

SH19-6842

Programming

Language Guide and Reference

SH19-6817

User interface

Viewer Guide

SH19-4517

Problem determination

Messages and Problem Determination

SH19-6902

Performance analysis

Accounting Feature for the Host

SH19-4495

Accounting Feature for the Workstation

SH19-4516

AS/400 System Performance Feature Guide and Reference

SH19-4019

Capacity Planner Feature Guide and Reference

SH19-4021

CICS Performance Feature Guide and Reference

SH19-6820

Distributed Systems Performance Feature Guide and Reference

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SH19-6825

Network Performance Feature Installation and Administration

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Network Performance Feature Reference

SH19-6822

Network Performance Feature Reports

SH19-6821

System Performance Feature Guide

SH19-6818
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PR/SM processing.
An Introduction to Performance Reporter and Capacity Planner

Tivoli Performance Reporter for OS/390 (hereafter referred to as Performance Reporter), is a reporting system that collects utilization and throughput data logged by computer systems, then summarizes the data and presents it in a variety of forms. Performance Reporter consists of a base product and several optional features that are used in systems management. Figure 1 shows the features available.

The Performance Reporter base includes:
- Interactive System Productivity Facility (ISPF) host reporting and administration dialogs
- Log collector
- Log and record definitions for all records used by the features

Each feature provides:
- Update definitions for DATABASE 2 (DB2) tables
- Table definitions
- Report definitions
The Performance Reporter database stores all reporting data, which comes from several sources. For example, logs from System Monitoring Facility (SMF), Resource Management Facility (RMF), Customer Information and Control System (CICS), and AIX can be consolidated into a single report. If you install all components of all Performance Reporter features and set system and subsystem data-recording parameters as recommended for each feature, you can ensure a steady supply of data about the operation of the entire DP center.

Capacity Planner uses your Performance Reporter database to produce a capacity plan for these resource types:
- Processor power
- Processor storage
- DASD I/O throughput
- DASD space.

Capacity Planner reports on OS/390 data and on VMPRF data about the processor utilization of each VM user class. Unless otherwise stated, VM refers to both VM/ESA and VM/XA operating systems, and MVS refers to both MVS/ESA and MVS/XA operating systems.

Understanding basic concepts of systems management

Performance Reporter assists you in performance management and service-level management of various computer systems. Performance Reporter’s Capacity Planner provides reports on a workstation that plan for OS/390 capacity. This topic prepares you for using Performance Reporter in practical systems analysis.

The term *systems management* covers a broad range of activities—from daily operations that manage the resources of an information system to the long-range planning that addresses the future information-processing needs of an organization.

As your organization explores new uses of its systems’ resources, your task is to keep pace with demands for new applications by knowing how the system is currently performing, knowing its latent capacity, and discovering and correcting constraints that cause less than optimal performance. The goal of systems management is to return the maximum value to a business from its information systems investment.

Planning for chargeback

There is a close relationship between capacity planning and chargeback. If you make a charge for the use of data processing (DP) services in your enterprise, your charges will be affected by the capacity plan. For example, a planned processor upgrade must be paid for, and it is fair to pass the cost to the users, even though the processor is below full capacity. Computer users pay just as much for unused capacity as for used capacity.

It is expensive to have too much spare capacity, and the capacity plan can be used to justify planned upgrades. There is some element of risk or uncertainty in any plan, and the margin of error must depend on the risk to the enterprise of undercapacity.

When upgrades are planned, the cost is added to the cost pool for that resource, and the increased value of the pool increases the unit charge for its contributors. For example, if you add disk capacity, this increases the unit disk cost, because the cost of the new disks is
added to the total cost of the disk space resource, which is then spread over the existing user base. Unless the new disk space is immediately used, the extra capacity results in a higher charge per gigabyte.

**Collecting performance data**

Before you can analyze data and make a capacity plan, you must first collect the data. All IBM systems and subsystems provide data on how well they perform.

Performance Reporter and Capacity Planner collect only the data required to meet your needs, combine that data with more data (called *environment data*), and present the data in reports. Figure 3 illustrates how data is organized for presentation in Performance Reporter reports.

![Diagram](image)

*Figure 2. Organizing and presenting system performance data*

The key to successful implementation of Performance Reporter is knowing:
The information and resources on which you want to report and how to perform customization to select them

- The way you want to organize, set objectives for, and process the data (used later to define the environment)

The process of entering and maintaining environment data is called *administration*. Performance Reporter provides an administration dialog for maintaining resource information. For more information on how to use the administration dialog, refer to the *Administration Guide*. 
Installing Capacity Planner

Capacity Planner has:

- Performance Reporter tables and other objects for data collection
- Code in the administration dialog that supports the workstation-initiated download process
- A Presentation Manager dialog. This dialog, running under OS/2 on a workstation, is central to the feature. You use it to:
  - Download data from the Performance Reporter database.
  - Specify your estimates of growth in demand.
  - Display and print reports.

Most of your work with the Capacity Planner dialog can be done offline (not connected to the central computer) because you normally download data once a month.

Implementing Capacity Planner on OS/390

This chapter describes how to plan for and set up Capacity Planner. It supplements the procedure in the Administration Guide for installing a component with information specific to Capacity Planner.

Planning the implementation process

Before installing Capacity Planner, you need to determine:

1. Which resources you want to plan for.
2. Which components you need to gather this data.
3. What administration tasks you must perform for the selected components, and make any decisions required by these tasks.

If this is your first exercise in implementation planning, follow all these steps to ensure that the Capacity Planner’s implementation is consistent. If you are reading this chapter in preparation for modifying your system, you might not need to perform all of these tasks.

Use the planning process to prepare for these main customization tasks:

- Customizing OS/390 to generate the data required by the components you install.
- Defining environment data, which is all the information (besides the input data) that Capacity Planner needs to create reports. Environment data controls the data-collection process and provides more information in the reports.
Implementing Capacity Planner

Figure 3 illustrates the process for implementing Capacity Planner.

Considering which components to install

Decide what resources to plan for. For example, your management may be interested only in planning for processor capacity. Installing only those parts of the feature needed to meet user requirements ensures that the feature benefits users while it minimizes the performance impact caused by data collection and interpretation activities.

Capacity Planner can plan for these four types of resource:

- Processor power
- Processor storage
- DASD I/O
- DASD storage
When you have decided which of these four resource types you need to plan for, you can then select the related components of the feature. Capacity Planner is divided into three components:

- MVS data (processor power and storage, DASD I/O)
- VM data (processor power)
- DASD storage data

Components are groups of Performance Reporter objects (for example, update definitions and data tables) that process log data so that it is ready for downloading to the workstation. If you do not install a component that you need, the table will be empty or missing when you download data, so you cannot do capacity planning for that type of resource.

**Installing the components**

After you have successfully installed the Performance Reporter base and features, you can load the related feature components. The necessary log and record definitions, tables, record procedures, update definitions, and reports to Performance Reporter system tables are then installed.

You must install the MVS data component of Capacity Planner, but the VM and DASD storage data components are optional. Install only the components that meet your needs, or you waste system resources. You can install Performance Reporter features and components the same way. Use the administration dialog, to select which components of Capacity Planner you want to install.

Perform the following steps:

1. From the Administration window (Figure 4), select 1, System, and press Enter.
2. Select 2, System tables, and press Enter.
3. Press F6 (Update) to load the component description files for Capacity Planner from the SMP/E target library (SDRLDEFS) into the database.
4. Return to the Administration window (Figure 4 on page 11), select 2, Components, and press Enter.

   Performance Reporter displays the Components window (Figure 5).

5. From the Components window, select the components to install (here, the Capacity Planner MVS Data Component) and press F6.

6. The Installation Options window is displayed (Figure 6).

---

![Figure 5. Components window](image)

![Figure 6. Installation Options window](image)

---

Implementing Capacity Planner

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Release 5
7. Use the component-installation procedure in the [Administration Guide](#) to specify whether to install the component online or in batch mode.

Installation of Capacity Planner can result in a great amount of output, so it is recommended that you install components in batch.

- If you specify online installation, Performance Reporter displays the Lookup Tables window. (For more information, see [Updating the lookup tables](#).)
  - To edit a lookup table using ISPF edit, select a table and press Enter.
  - You can also use the QMF table editor:
    - To edit a lookup table using the QMF table editor in add mode, press F5 (QMF add).
    - To edit a lookup table using the QMF table editor in change mode, press F6 (QMF chg).

- If you specify batch mode, Performance Reporter starts an ISPF edit session, from which you can edit and submit the installation JCL. Batch installation messages identify the lookup tables that require editing. (For more information, see [Updating the lookup tables](#).)

When you have finished editing lookup tables, Performance Reporter continues with the installation. After installation is complete, Performance Reporter returns to the Components window, and the Status field indicates that the component is installed.

### Specifying the DASD storage class option

If you are planning DASD storage capacity, you can choose whether to plan by DFSMS storage class (the default) or by project. To plan by project:

1. Select option 4 (Tables) of the Administration dialog.
2. Type s beside the CP_DASDSPACE_D table and press F5 (Updates).
3. Type s beside the CP_DASDSPACE_D update definition and press Enter.

   Note that the derivation of the STORAGE_CLASS key column is an expression involving the TYPE1 field. This is the default grouping by storage class.

4. Change TYPE1 to TYPE2.
5. Press F3 (Exit) to save the change to the update definition.

**Note:** This changes only the database definition and does not alter the definition in the SDRLDEFS target library. So you must make the change again if you reinstall the component. To make a permanent change, change the DRLTCPD member in the SDRLDEFS target library. Search for TYPE1, and make the change as documented in comment lines in that member.

### Updating the lookup tables

You must update these lookup tables:

- **CP_PROCESSOR**
  - Use this table to specify the physical and logical processors in your systems.

- **CP_STORAGE_CLASS**
  - Use this table to specify the DFSMS classes for DASD space planning.
CP_WORKLOAD_TYPE  Use this table to specify each type of workload, with its performance group and default capture ratio.

Do not use global search characters (%, ?, *, and _) for these lookup tables, because they are downloaded to the workstation dialog, which does not recognize these as global search characters.

Defining the prime period

Capacity Planner uses data only for the peak hours, defined with the PRIME keyword in the PERIOD_PLAN control table, which is part of the Performance Reporter base. For details on this table, refer to the [Administration Guide](#).

Updating workload types

The CP_WORKLOAD_TYPE lookup table must have an entry for each performance group that you will use in capacity planning. This table is similar to the System Performance Feature lookup table MVS_WORKLOAD_TYPE. For each OS/390 system that Capacity Planner will analyze, specify up to 20 workload types. Do not specify a workload type that uses an insignificant proportion of your resources—include this in SYSTEM or OTHER. For each workload type, specify its performance groups as in the IEAICSnn member of SYS1.PARMLIB. If a performance group is specified in CP_WORKLOAD_TYPE, you can report on it individually by defining it as an application using the Capacity Planner workstation dialog. For this reason, define a workload type OTHER with all the performance groups not otherwise allocated.

If you are creating a table with entries for more than one OS/390 system, specify the same names for the same workload types on each system. For example, if you specify CICS on system IPO1, specify CICS on system IPO2, instead of calling the workload types CICS1 and CICS2. This makes it possible to forecast on the combined CICS workload of IPO1 and IPO2 without having to define applications.

Specify a default capture ratio for each workload type. This is the ratio of measured work to total work. You can use the workstation dialog to calculate an accurate value, so do not worry about setting an accurate value in the table—it is useful, though, for documentation.

**Example of table contents**

<table>
<thead>
<tr>
<th>MVS</th>
<th>PERF</th>
<th>GROUP</th>
<th>WORKLOAD</th>
<th>CAPTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM</td>
<td>ID</td>
<td>NO</td>
<td>TYPE</td>
<td>RATIO</td>
</tr>
<tr>
<td>------</td>
<td>-----</td>
<td>-----</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>MVS1</td>
<td>0</td>
<td>SYSTEM</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS1</td>
<td>1</td>
<td>BATCH</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS1</td>
<td>2</td>
<td>TSO</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>MVS1</td>
<td>3</td>
<td>IMS/CICS</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS1</td>
<td>4</td>
<td>CLEAR</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>MVS1</td>
<td>5</td>
<td>JES2</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>MVS1</td>
<td>6</td>
<td>BATCH</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>0</td>
<td>SYSTEM</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>1</td>
<td>BATCH</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>2</td>
<td>TSO</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>3</td>
<td>IMS/CICS</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>4</td>
<td>CLEAR</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>5</td>
<td>JES2</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>6</td>
<td>BATCH</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>0</td>
<td>SYSTEM</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>MVS4</td>
<td>1</td>
<td>BATCH</td>
<td>0.90</td>
<td></td>
</tr>
</tbody>
</table>
The workstation dialog uses this table to determine whether an OS/390 system runs alone or under PR/SM or VM. If the OS/390 system runs under PR/SM or VM, this table tells the workstation dialog what other partitions or VM user classes share the physical machine.

Example of table contents

<table>
<thead>
<tr>
<th>MVS_SYSTEM_ID</th>
<th>LPAR_NAME</th>
<th>PROCESSOR_TYPE</th>
<th>SRM_CONSTANT</th>
<th>LOGICAL_PROCS</th>
<th>PHYSICAL_PROCS</th>
<th>PARTITIONS</th>
<th>CS_STORAGE</th>
<th>ES_STORAGE</th>
<th>VM_INDICATOR</th>
<th>LPAR_INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPO1</td>
<td>9021-500</td>
<td>1104</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>6.400E+01</td>
<td>5.120E+02</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PROD PART1</td>
<td>9021-720</td>
<td>1069</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>6.400E+01</td>
<td>5.120E+02</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PROD PART2</td>
<td>9021-720</td>
<td>1069</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>6.400E+01</td>
<td>5.120E+02</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TEST PART1</td>
<td>9021-720</td>
<td>1069</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>3.200E+01</td>
<td>6.400E+01</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TEST PART2</td>
<td>9021-720</td>
<td>1069</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>3.200E+01</td>
<td>6.400E+01</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TEST PART3</td>
<td>9021-720</td>
<td>1069</td>
<td>16</td>
<td>6</td>
<td>3</td>
<td>3.200E+01</td>
<td>6.400E+01</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>IPO2 MVS1</td>
<td>3090-300</td>
<td>724</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>6.400E+01</td>
<td>2.560E+02</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>IPO2 NONMVS</td>
<td>3090-300</td>
<td>724</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>6.400E+01</td>
<td>2.560E+02</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

This table is downloaded, with summarized data, to the workstation dialog. For this reason, do not use global search characters when building this table.

Stand-alone OS/390 System

This is how to code the lookup table when you have stand-alone OS/390 systems.

**MVS_SYSTEM_ID**
SMF identifier. You can define up to 20 systems.

**LPAR_NAME**
Not used. Set to a null string or spaces.

**PROCESSOR_TYPE**
Processor type. This is an information field, up to 8 characters.

**SRM_CONSTANT**
SRM constants from the following manuals:
- *MVS/ESA SP Initialization and Tuning Guide*, “Selecting Service Definition Coefficients”, (Worksheet Number 1)
- *MVS/ESA SP Planning: Workload Management*, “CPU Capacity Table”, “Selecting Service Definition Coefficients”
- *OS/390 Planning and Installation*, “Appendix B, CPU Capacity Table”.

**PHYSICAL_PROCS**
Number of physical processors.

**PARTITIONS**
Set to zero.

**LOGICAL_PROCS**
Set to zero.

**CS_STORAGE**
Central storage in megabytes.

**ES_STORAGE**
Expanded storage in megabytes.

**VM_INDICATOR**
Set to zero.

**LPAR_INDICATOR**
Set to 1.
PR/SM System
This is how to code the lookup table when you have a partitioned processor running OS/390 systems.

- **MVS_SYSTEM_ID**: SMF identifier of the reference MVS system (see “Explanation of LPAR_INDICATOR” on page 17).
- **LPAR_NAME**: Partition name from the PR/SM hardware console.
- **PROCESSOR_TYPE**: Processor type. This is an information field, up to 8 characters.
- **SRM_CONSTANT**: SRM constants from the *MVS Initialization and Tuning Guide*.
- **PHYSICAL_PROCS**: Number of physical processors.
- **PARTITIONS**: Number of partitions.
- **LOGICAL_PROCS**: Number of logical processors, from the PR/SM hardware console.
- **CS_STORAGE**: Central storage allocated to the system MVS_SYSTEM_ID, in megabytes.
- **ES_STORAGE**: Expanded storage allocated to the system MVS_SYSTEM_ID, in megabytes.
- **VM_INDICATOR**: Set to zero.
- **LPAR_INDICATOR**: Set to 1 for the reference system. Set to 0 for other partitions running in the same machine as the reference system. See “Explanation of LPAR_INDICATOR” on page 17.

VM System
This is how to code the lookup table when you have OS/390 systems running under VM.

- **MVS_SYSTEM_ID**: SMF identifier of the reference OS/390 system (see “Explanation of LPAR_INDICATOR” on page 17).
- **LPAR_NAME**: VMPRF user class name.
- **PROCESSOR_TYPE**: Processor type. This is an information field, up to 8 characters.
- **SRM_CONSTANT**: SRM constants from the *MVS Initialization and Tuning Guide*.
- **PHYSICAL_PROCS**: Number of physical processors.
- **PARTITIONS**: Number of user classes.
- **LOGICAL_PROCS**: Not used for VM. Set to zero.
- **CS_STORAGE**: Central storage allocated to the system MVS_SYSTEM_ID, in megabytes.
- **ES_STORAGE**: Expanded storage allocated to the system MVS_SYSTEM_ID, in megabytes.
- **VM_INDICATOR**: Set to 1.
- **LPAR_INDICATOR**: Set to 1 for the reference system. Set to zero for other user
classes running in the same VM system as the reference system. See [Explanation of LPAR_INDICATOR].

**Explanation of LPAR_INDICATOR**

For each OS/390 system that you want to report on (a reference system), you must have a row for each partition. In Figure 7 on page 15, for example, two OS/390 systems are running under PR/SM. One SMF ID is PROD, and the other is TEST. For each OS/390 system, three rows exist in the parameter table. One row, where LPAR_INDICATOR=1, is for the OS/390 system that will be the reference system. The rows that have MVS_SYSTEM_ID=PROD and LPAR_INDICATOR=0 are for the partitions running alongside system PROD.

When you specify a PR/SM report for reference system PROD on the workstation dialog, Capacity Planner looks in CP_PROCESSOR searching for all the rows that contain MVS_SYSTEM_ID=PROD. It should find one row where LPAR_INDICATOR=1. This is for the reference system itself. There may be other rows that have LPAR_INDICATOR=0. These are the partitions that run alongside system PROD. They do not have to be OS/390 systems.

**CP_STORAGE_CLASS**

This table describes the storage classes that are defined to DFSMS, or the project names if you have chosen to report on project rather than storage class. You can define up to 20 storage classes or project names for each OS/390 system. If you have changed the CP_DASDSPACE_D update the table so that DASD space is grouped by project, check that the project names in this table correspond to those in the DFSMS_DS_OWNER lookup table, which belongs to the DFSMS component of the System Performance feature.

<table>
<thead>
<tr>
<th>MVS SYSTEM_ID</th>
<th>STORAGE_CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVS1</td>
<td>CICSPROD</td>
</tr>
<tr>
<td>MVS1</td>
<td>DB2</td>
</tr>
<tr>
<td>MVS1</td>
<td>DLIBS</td>
</tr>
<tr>
<td>MVS1</td>
<td>IPO1</td>
</tr>
<tr>
<td>MVS1</td>
<td>SPOOL</td>
</tr>
<tr>
<td>MVS1</td>
<td>SYS1</td>
</tr>
<tr>
<td>MVS1</td>
<td>SYS2</td>
</tr>
<tr>
<td>MVS1</td>
<td>TEST</td>
</tr>
</tbody>
</table>

*Figure 8. Specifying storage classes*

This table is downloaded, with summarized data, to the workstation dialog. For this reason, do not use global search characters when building this table.

This is an explanation of the columns:

- **MVS_SYSTEM_ID**: SMF identifier. You can define up to 20 systems.
- **STORAGE_CLASS**: Storage class name, or project name if you choose to report on project rather than storage class. You can define up to 20 storage classes or project names for each OS/390 system. If you have changed the CP_DASDSPACE_D update the table so that DASD space is grouped by project, check that the project names in this table correspond to those in the DFSMS_DS_OWNER lookup table, which belongs to the DFSMS component of the System Performance feature.
Collecting data

Before you collect data, check that all the necessary SMF records are being written. These SMF records are necessary for Capacity Planner:

- SMF record type 30, subtypes 2 and 3
- SMF RMF record type 70
- SMF RMF record type 71
- SMF RMF record type 72
- SMF RMF record type 79
- DFP 3.2 with IDCAMS DCOLLECT.

Check in the active SMFPRMnn member of SYS1.PARMLIB that these SMF records are being written. Figure 9 shows a typical entry for TSO.

You must have RMF Monitor II running, at least for the peak hours, to produce the type 79 subtype 1 records, which are necessary for processor storage information.

1. Put these parameters in member ERBRMFCP of SYS1.PARMLIB:

   - ASD(A.A.A)
   - RECORD
   - NOREPORT
   - SINTV(900) /* make this interval the same as SMF */
   - NOSTOP.

2. Issue this modify command to start Monitor II:

   `F RMF,S AB,MEMBER(CP)`

   You can automate this by adding this command to the OS/390 start-up commands or by using a product such as NetView to issue this command at a specified time.

VMPRF data

If you already have a VMPRF collect job, you can use this job without any alteration. For instructions on collecting VMPRF data, refer to the System Performance Feature Reference.

DASD storage data

If you already have a job to collect DCOLLECT data for the DFSMS component of the System Performance feature, you can use it for Capacity Planner.
For producing and collecting this data, follow the instructions in the System Performance Feature Reference.

Testing the installation

Before starting the daily use of Capacity Planner, run a few tests to ensure that the installation was successful. This step verifies that Performance Reporter is collecting the right data, storing the data correctly, and using the correct data to create reports. Testing the installation also confirms that the lookup tables contain correct values. Refer to the Administration Guide for the steps involved in testing component installation.

Optimizing data collection

The Administration Guide describes how to optimize Performance Reporter data collection by specifying only the needed tables in the INCLUDE (or EXCLUDE) clauses of the COLLECT statement. The example in Figure 10 shows how to selectively include data tables supplied with Capacity Planner.

If you are not concerned with planning for processor storage, for example, omit the INCLUDE for CP_STORAGE_M.

To include all Capacity Planner tables, use the command COLLECT SMF INCLUDE LIKE 'DRL.CP_\%'.

Checking Performance Reporter parameters

Check that the lookup tables are edited so that you get the data that you need in the Performance Reporter database.

Peak Hours

Performance Reporter usually processes data from OS/390 once a day, summarizing and storing the data. For capacity planning purposes, only the peak hours (the hours when the
load is heaviest) are important. Data from these hours is summarized in the Capacity Planner tables for downloading to the workstation. Check what hours are selected.

For example, consider a system which has peak hours from 10:00 to 11:00 and from 13:00 to 15:00. If an online application extends its service hours by one hour to 19:00, this probably does not affect your capacity plan, because the hour from 18:00 to 19:00 is not a peak hour. It will be important only if 18:00 to 19:00 becomes a peak hour because of the change. If this happens, change the PERIOD_PLAN control table to specify this new peak hour as PRIME.

Note: For DASD storage, Capacity Planner uses only the peak value for the month.

Log data

Check what logs are being collected. Capacity Planner supports these resource types:

- Processor power
- Processor storage
- DASD I/O throughput
- DASD space.

The first three use SMF records. Check that RMF Monitor II collects the records (type 79 subtype 1) necessary for processor storage analysis, and that SMF type-30 records, subtypes 2 and 3, are written.

The last type, DASD space, uses data generated by the IDCAMS utility DCOLLECT command. Check that this is run and the data is collected, as for the DFSMS component of the System Performance feature. Figure 11 shows which update definitions are used to update each Capacity Planner data table.

<table>
<thead>
<tr>
<th>Source</th>
<th>Updates</th>
<th>Target tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMF_070</td>
<td>CP_CPU1_M</td>
<td>CP_CPU_M</td>
</tr>
<tr>
<td>SMF_070_X</td>
<td>CP_CPU2_M</td>
<td>CP_CPU_M</td>
</tr>
<tr>
<td>SMF_070_X</td>
<td>CP_CPU3_M</td>
<td>CP_CPU_M</td>
</tr>
<tr>
<td>DCOLLECT_DA</td>
<td>CP_DASDSPACE_D</td>
<td>CP_DASDSPACE_D</td>
</tr>
<tr>
<td>CP_DASDSPACE_D</td>
<td>CP_DASDSPACE_M</td>
<td>CP_DASDSPACE_M</td>
</tr>
<tr>
<td>SMF_030</td>
<td>CP_JOB_M</td>
<td>CP_JOB_M</td>
</tr>
<tr>
<td>SMF_070_X</td>
<td>CP_LPAR_M</td>
<td>CP_LPAR_M</td>
</tr>
<tr>
<td>SMF_071</td>
<td>CP_PAGING_M</td>
<td>CP_PAGING_M</td>
</tr>
<tr>
<td>SMF_079</td>
<td>CP_STORAGE_M</td>
<td>CP_STORAGE_M</td>
</tr>
<tr>
<td>SMF_071</td>
<td>CP_TIME_M</td>
<td>CP_TIME_M</td>
</tr>
<tr>
<td>VMRF_02</td>
<td>CP_VMRF02_M</td>
<td>CP_VMRF02_M</td>
</tr>
<tr>
<td>VMRF_41</td>
<td>CP_VMRF41_M</td>
<td>CP_VMRF41_M</td>
</tr>
<tr>
<td>SMF_072_1</td>
<td>CP_WKLOAD_M</td>
<td>CP_WKLOAD_M</td>
</tr>
</tbody>
</table>

Figure 11. Capacity Planner update definitions
Workload types

Capacity Planner can analyze the processing for the most significant workload types (up to 20 types). These can be TSO, CICS, BATCH, and DB2, for example. OS/390 can record these separately if they are in separate performance groups. Choose these workload types when you edit the CP_WORKLOAD_TYPE lookup table. Do not choose a workload type if it uses an insignificant proportion of machine resources.

Putting the feature into production

After you run the tests and verify that the installation is successful, you can put Capacity Planner and its components into production. Figure 12 shows the daily and monthly tasks involved in using Capacity Planner.

<table>
<thead>
<tr>
<th>Daily jobs</th>
<th>MVS component</th>
<th>VM component</th>
<th>DASD space component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect SMF</td>
<td>Collect VMPRF</td>
<td>Collect DCOLLECT</td>
<td>(as for VMPRF in the SP feature)</td>
</tr>
<tr>
<td>INCLUED in the COLLECT job</td>
<td>CP_WKLOAD_M</td>
<td>CP_VMPRF02_M</td>
<td>CP_DASDSPACE_D</td>
</tr>
<tr>
<td></td>
<td>CP_TIME_M</td>
<td>CP_VMPRF41_M</td>
<td>CP_DASDSPACE_M</td>
</tr>
<tr>
<td></td>
<td>CP_STORAGE_M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP_JOB_M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP_PAGING_M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP_LPAR_M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP_CPU_M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly jobs</td>
<td>Download data to the workstation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 12. Steps involved in using Performance Reporter

Workstation installation

There are two ways of organizing your program and data files: a normal organization, and a directory organization that you should use if you keep programs on a local area network (LAN) server.

Normal organization

This is the simplest directory structure if you do not use a LAN:

| Working directory | A directory for programs, help files, DRLCP.INI, DASDGB.DAT, and DASDTAB.DAT. If there is an entry for the working directory in the LIBPATH statement, you need not alter CONFIG.SYS. The working directory is specified as a period (·).
| Data directories  | Directories for the data and profiles. There is normally one directory—DEMO—for demonstration data, and one for your own data. |

LAN organization

Have this directory structure when you use a local area network (LAN) server:

| Program directory | A directory for programs and help files. Specify this |
directory in the LIBPATH, PATH, and HELP statements in CONFIG.SYS. You can read-protect this directory and have it on the LAN server.

**Working directory**
A directory for DRLCP.INI, DASDGB.DAT, and DASDTAB.DAT. This is \DRLCP on your workstation.

**Data directories**
Directories for the data and profiles. There is normally one directory—DEMO—for demonstration data, and one for your own data.

**Programs and files**
These are the files that Capacity Planner uses on the workstation:

**Program file, DRLCP.EXE**
The extension is EXE. You can execute DRLCP.EXE from a directory that is not the working directory, for example a read-only directory on a LAN, if you have the directory in the PATH statement in your CONFIG.SYS file. For more information on how to alter CONFIG.SYS, see “Completing the installation” on page 25.

**DLL files**
The extension is DLL. OS/2 uses the LIBPATH statement to find the DLL files. If it finds a period (·) in the search list, it looks in the working directory.

You can install the DLL files in a read-only directory on a LAN, but you must in this case specify the read-only directory in the LIBPATH statement. For more information on how to alter CONFIG.SYS, see “Completing the installation” on page 25.

**Help library, DRLCP.HLP**
If this file is not in the working directory, specify the directory name in the HELP statement. For more information on how to alter CONFIG.SYS, see “Completing the installation” on page 25.

**DASDTAB.DAT**
This file, listed in “BCU Values” on page 99, is a parameter table with basic configurable unit (BCU) specifications.

**DASDGB.DAT**
This file, listed in “DASD Space” on page 103, is a parameter table with the DASD space for each DASD type.

**DRLCP.INI**
This file contains parameters related to your OS/2 environment, such as the colors and fonts selected. It is created the first time you use Capacity Planner, and is written to the working directory.

**Data files**
The extension is DAT. You normally download these files each month.

**Profiles**
The extension is PRO. Create a profile when you first use Capacity Planner. See “Managing Data on the Workstation” on page 41.

If you install Capacity Planner directly from the central computer, see “Installing Capacity Planner from the central computer” on page 23. If you install Capacity Planner from a LAN, see “Installing Capacity Planner from a local area network” on page 25.
Installing Capacity Planner from the central computer

Follow these steps:

1. Open an OS/2 window.

2. Select the directory that you want to install Capacity Planner into. For example, type these commands to create a new directory DRLCP:
   
   ```
   cd c: \n   md drlcp
   cd drlcp
   ```

   The installation program creates a subdirectory for the demonstration data.

3. Log on to TSO/E on the OS/390 system using a 3270 emulator session. The TSO READY prompt is displayed.

4. From the OS/2 window, enter this command to receive the English version of the installation program:
   
   ```
   receive drlcpins.exe ha:'drl150.sdrlbenu(drlcpins)'
   ```
   
   or use an equivalent file transfer command. The above command assumes that:

   - The emulator session is A (specified as HA: or A: depending on your installation).
   - For the English version of the installation program, the partitioned data set (PDS) is DRL150.SDRLBENU.
   - For the Japanese version of the installation program, the partitioned data set (PDS) is DRL150.SDRLBJPN.

5. When the installation program has been downloaded, enter the command:
   
   ```
   drlcpins
   ```

   The window in Figure 13 on page 24 is displayed.
6. Fill in the fields as follows:

- Select Install the demonstration data—you need this for Chapter 5 ["Using Capacity Planner" on page 51].
- Select Update CONFIG.SYS and save the current version as CONFIG.BAK. This adds the program directory (DRLCP or whatever you have specified) to the LIBPATH statement.
- Type or select the name of the emulator session—A in this example.
- Type the name of the partitioned data set containing Capacity Planner base code—the window shows DRL150.SDRLBIN.
- Type the name of the partitioned data set containing Capacity Planner code for your installed language, which can be English, or Japanese (kanji). The window shows DRL150.SDRLBENU. The default kanji name is DRL150.SDRLBJPN.
- Specify \DRLCP as the target program directory. The default drive and directory is the one that the program is being run from.
- Specify \DRLCP\DEMO as the target demonstration data directory.

7. After you have selected the options on the Capacity Planner Installation window, click Install. The Installation Progress window is displayed.

8. When you have downloaded all files successfully, continue with the procedure described in ["Completing the installation" on page 25].
Installing Capacity Planner from a local area network

Follow these steps:

To run Capacity Planner from the LAN, you must create a working directory and the data directories.

1. Install Capacity Planner on the LAN server. Follow the steps described in "Installing Capacity Planner from the central computer" on page 23. The program files are in a directory on the server. Assume, for example, that they are in U:\DRLCP.

2. Open an OS/2 window on your workstation.

3. On the OS/2 command line, enter the following commands:
   
   ```
   cd c:\
   md drlcp
   cd drlcp
   md demo
   md test
   ```

   4. This creates the working directory DRLCP, with a subdirectory DEMO for demonstration data, and a subdirectory TEST for your data, in the root directory of the C drive.

5. Add U:\DRLCP in the LIBPATH, PATH, and HELP statements in your CONFIG.SYS file, as shown in "Completing the installation".

6. Copy the DASD parameter files to your working directory:
   
   ```
   copy u:\drlcp\dasd*.dat c:\drlcp
   ```

7. Copy the demonstration data to your DEMO subdirectory:
   
   ```
   copy u:\drlcp\demo\*.* c:\drlcp\demo
   ```

8. Continue with the procedure described in "Completing the installation".

Completing the installation

If you did not use the DRLCPINS program to update CONFIG.SYS, or you are running Capacity Planner from a directory that is not the working directory, update CONFIG.SYS with a text editor, as shown in Figure 14 on page 26.
How to update CONFIG.SYS

001
Are you running Capacity Planner from the working directory?
Yes         No

002
Edit CONFIG.SYS and update the LIBPATH, PATH and HELP statements.

003
Did you use DRLCPINS to update CONFIG.SYS?
Yes         No

004
Does your CONFIG.SYS have a period and a semicolon (.;) in the LIBPATH statement?
Yes         No

005
Edit CONFIG.SYS and add a period and a semicolon (.;) to the LIBPATH statement.

006
Continue with the installation.

007
Continue with the installation.

Figure 14. CONFIG.SYS File

Add the highlighted text to CONFIG.SYS. Replace U:\DRLCP with the directory that you have installed the program and help library on. Shut down and restart OS/2 when you have updated CONFIG.SYS.

If you use OS/2 Version 2, see "Adding Capacity Planner to a folder in OS/2 Version 2" on page 27. If you use OS/2 Version 1.3, see "Adding Capacity Planner to a group in OS/2 Version 1.3" on page 27.
Adding Capacity Planner to a folder in OS/2 Version 2
To add Capacity Planner to a folder:

1. Double-click the Templates folder.
2. Drag the Program template to your application folder. The Settings notebook for the new program is displayed.
3. Specify the path and file name of the program. For example:
   c:\drlcp\drlcp.exe
   If you are running Capacity Planner from the LAN, specify the LAN directory instead.
4. Specify the working directory. For example:
   c:\drlcp
5. Select the General tab, and change the program title to Capacity Planner.
6. Close the Settings notebook.
7. To start the program, double-click the program icon.

Adding Capacity Planner to a group in OS/2 Version 1.3
To add Capacity Planner to an application group:

1. Click the Group window to make it the active window.
2. From the menu bar, select Program.
4. Type Capacity Planner in the Program title field.
5. Specify the path and file name of the program. For example:
   c:\drlcp\drlcp.exe
   If you are running Capacity Planner from the LAN, specify the LAN directory instead.
6. Specify the working directory. For example:
   c:\drlcp
7. Click the arrow in the Program type field and select Presentation Manager.
8. To start the program, double-click Capacity Planner in the Group window.
3

Introduction to Capacity Planning

This chapter introduces the principles of capacity planning. How Capacity Planner processes the input data is explained in “Calculations in Capacity Planning” on page 105.

Balanced systems

A system is in balance when the processor and its storage and attached devices are configured so that nothing is over- or underused. As the workload increases on such a system, you must adjust the different resources (processor, storage, channel configuration, and DASD) so that the system stays in balance. The adjustment depends on the type of workload. For example, if much of the growth is in a processor-intensive application, processor upgrades are needed before upgrades to storage and to the DASD subsystem.

This balance is automatic with Capacity Planner, because you tell Capacity Planner the relative growth for each workload: Capacity Planner uses Performance Reporter data to translate that into an increased utilization for each resource. For example, you tell Capacity Planner that CICS workload will grow by 50% within the next year. Capacity Planner can calculate from your Performance Reporter data how processor intensive and how storage intensive CICS is, so it can calculate the resulting increase in processor and storage requirement. For a worked example, see “Example of capacity planning” on page 34.

To make Capacity Planner produce a credible capacity plan, feeding data it’s not enough. You also have to carefully consider:

Latent demand on your system

If performance is poor, measurements from RMF do not reflect how much work your users want to do—just how much they can do. See “Latent demand” on page 30.

Constraints that are not removed by adding resources

If 90% of your work is performed on an online system that updates one data set intensively, it is unlikely that adding resources will help. See “Constraints on growth” on page 31.

High and low priority work

Your application priorities affect the result of upgrades and of merging systems. See “High and low priority work” on page 31.

Different causes of growth

See “Causes of increased demand” on page 33.

Skew factors

See “Skew factor” on page 34.
Latent demand

Capacity planning uses peak-hour data. Be aware that if the system is already overloaded and performance is poor during the peak hours, users avoid using it then. If they know that performance is poor between 14:00 and 16:00, they probably plan not to use it at this time. But when you tell them that the system has been upgraded, they will start using it when it suits them, rather than when it suits the system. This means that there is a latent demand in the system which must be taken into account before the system is upgraded.

In Figure 15 and Figure 16: the lower dashed horizontal line shows the average processor utilization. The ratios of the average to the peak usage in Figure 15, represented by the two arrows, would probably not change if the processor were less busy. To test this, you could look at a graph where the peak is well below 100%.

In Figure 16, the ratios of the average to the peak usage is less, and if the processor were upgraded, the peak usage would increase because of latent demand. This ratio is the peak-to-average (PA) ratio.
Constraints on growth

Figure 17 shows a system running CICS. The CICS system accounts for more resource usage, and one transaction, ABCD, accounts for more processing time in CICS. Transaction ABCD uses a disk log, perhaps logging the input message and updated database records. If the response time for this data set I/O is 20 ms, and each transaction performs five I/Os to the log, the system can run only 10 transactions a second, at best. Doubling the number of disk drives and the amount of central storage and upgrading the processor has no effect, unless the number of I/Os can be reduced by buffering.

Other examples of constraints are:
- An ENQ
- Access to a shared data set constrained by global resource serialization.

As a capacity planner, you assume that you can extrapolate information from your data. A constraint can invalidate this assumption, and a constraint is often detected only when it causes a performance problem. Constraints are most apparent when the system has a few heavy tasks to do. The greater the mix of work, the less noticeable the constraints. Poor application design can cause such constraints.

High and low priority work

The topic "Latent demand" on page 30 warns against basing a plan on data for a system that is already heavily used. Many enterprises run batch streams alongside online systems, to soak up spare processing capacity (not forgetting that many batch jobs are important, too).

Does running concurrent batch jobs invalidate the data?

In Figure 18 on page 32, batch A runs at lower priority than the CICS system. If CICS load increases, the proportion of online work increases—leaving less room for batch. Therefore, CICS is not constrained by the batch work, assuming that the batch work does not create a shortage of central storage. High priority work is not affected by low
priority work. The CICS system will be affected, however, by the batch work if paging occurs, because CICS will suffer more page faults. Also, the batch work may compete for a channel or actuator that CICS uses.

**What about combining systems?**

Figure 18 shows a second system, B, that runs a second CICS system. Can the two systems safely be combined on a processor with double the power? This partly depends on the type of upgrade. Twice the power can mean one processor at twice the speed, or a dual processor. A single processor at twice the speed can be a good choice for CICS systems because much of the work runs as a single task. But at higher utilizations, less queueing occurs with two servers.

![Figure 18. Processor utilization in two systems](image)

**What about special constraints?**

For example, when systems A and B are combined in a faster processor, the CICS systems compete for resources. If CICS B has higher priority (a business decision, not a data processing decision), it uses as much of the faster processor as it needs, causing performance problems for CICS A. This is because there is latent demand in CICS B. The result is shown in the histogram in Figure 19 on page 33.
Causes of increased demand

Capacity Planner can analyze your data and make a forecast based on historical growth. This forecast may be inaccurate because historical data can ignore business changes. Forecasts depend on reliable historical data about a stable, if growing, system—data that may be currently unavailable.

Consider these factors:

Business changes

Your organization might be involved in mergers and acquisitions, or change the way it does business. Perhaps you will rationalize your data processing centers, concentrating processor power and expertise, or decentralize, giving autonomy to business centers. Any such change affects a capacity plan. The greatest danger is when the capacity planner is not aware of plans. Many changes, such as a takeover, are secret or unplanned. Company directors must know about the long-term nature of your planning process and take the time to treat it seriously. Their business schemes must consider the data processing implications.

Latent demand

As explained in “Latent demand” on page 30, latent demand is not really growth, but work that users want to do now but cannot do because performance is poor.

More users

Keep updated about the increasing number of users of the system. You can ask the relevant information to the network team that orders and installs the terminals.

Application changes

Application changes include changes to system software.
Perhaps the new release of your sort program uses expanded storage. A change to an application program can change its relative I/O content (RIOC).

**New tools**

The introduction of new languages can dramatically increase demand, especially when users start to develop application programs.

**Increased usage**

Some users may simply work more. This is related to the success of your business. Variation in usage can also be seasonal.

So keep informed. Talk to system analysts, company directors, users, and computer sales representatives. They have opinions about what should be done in your DP department. By experimenting with the hypothetical movement of work from one system to another, you can also be influential.

Remember that growth does not affect all resources equally. Capacity Planner lets you specify different rates of growth for processor power, processor storage, and DASD space.

**Skew factor**

Adding resources does not always give you proportionally more throughput. Experience shows that each additional processor, or string of DASD, may give a little less throughput than the existing one. The [Table 1](#) shows the diminishing returns for additional processors and groups of actuators.

### Table 1. Diminishing returns from additional resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Effective throughput (processor)</th>
<th>Effective throughput (DASD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First processor or 8 actuators</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Second processor or 8 extra actuators</td>
<td>0.85</td>
<td>0.94</td>
</tr>
<tr>
<td>Third processor or 8 extra actuators</td>
<td>0.75</td>
<td>0.85</td>
</tr>
<tr>
<td>Fourth processor or 8 extra actuators</td>
<td>0.65</td>
<td>0.77</td>
</tr>
<tr>
<td>Fifth processor or 8 extra actuators</td>
<td>0.55</td>
<td>0.71</td>
</tr>
</tbody>
</table>

**Example of capacity planning**

This example illustrates some of the principles of capacity planning. The data is simple and each step in the calculations is shown, so that you can understand better what the Capacity Planner dialog does for you.

Consider some peak-hour data for the two systems SYS1 and SYS2.

### Table 2. SYS1 and SYS2

<table>
<thead>
<tr>
<th>Resource</th>
<th>SYS1</th>
<th>SYS2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSID</td>
<td>SYS1</td>
<td>SYS2</td>
</tr>
<tr>
<td>Processor</td>
<td>3090-200</td>
<td>3090-200</td>
</tr>
<tr>
<td>Average utilization (UTIL)</td>
<td>35%</td>
<td>80%</td>
</tr>
</tbody>
</table>
Table 2. SYS1 and SYS2 (continued)

<table>
<thead>
<tr>
<th></th>
<th>SYS1</th>
<th>SYS2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DASD I/O rate in I/Os per second</td>
<td>125</td>
<td>402</td>
</tr>
<tr>
<td>Central storage in MB</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Expanded storage in MB</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Estimated relative processor power (RPP)</td>
<td>1229</td>
<td>1229</td>
</tr>
<tr>
<td>Relative processor power used (RPPU)</td>
<td>430</td>
<td>983</td>
</tr>
<tr>
<td>Relative I/O content (RIOC)</td>
<td>0.29</td>
<td>0.41</td>
</tr>
<tr>
<td>Peak utilization</td>
<td>42.9%</td>
<td>99.3%</td>
</tr>
<tr>
<td>Peak-to-average ratio (PA)</td>
<td>1.23</td>
<td>1.24</td>
</tr>
<tr>
<td>Historical peak-to-average ratio (HPA)</td>
<td>1.25</td>
<td>1.45</td>
</tr>
<tr>
<td>Latent demand ((HPA x UTIL)−100)</td>
<td>0</td>
<td>16%</td>
</tr>
</tbody>
</table>

The historical peak-to-average ratio is taken from a time when the processor is lightly loaded. Use this table to calculate the likely peak usage in an unconstrained system, as described in “Latent demand” on page 30.

The relative I/O content (RIOC) is calculated as the DASD I/O rate divided by the power used (RPPU) and is a measure of how I/O intensive the work is. If the type of work does not change, the RIOC should be constant when the workload grows.

Table 3 shows the work running in SYS1, and Table 4 on page 36 shows the work running in SYS2.

Table 3. Work running on SYS1

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Processor usage from RMF (CPU)</th>
<th>Capture ratio (CR)</th>
<th>Relative processor power used (RPPU)</th>
<th>I/O count from RMF (IO)</th>
<th>Relative I/O content (RIOC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CICS1</td>
<td>12.5%</td>
<td>0.88</td>
<td>175</td>
<td>18.3</td>
<td>0.10</td>
</tr>
<tr>
<td>IMS1</td>
<td>7.8%</td>
<td>0.59</td>
<td>162</td>
<td>47.0</td>
<td>0.29</td>
</tr>
<tr>
<td>TSO1</td>
<td>0.3%</td>
<td>0.17</td>
<td>22</td>
<td>0.3</td>
<td>0.01</td>
</tr>
<tr>
<td>BATCH1</td>
<td>5.3%</td>
<td>0.88</td>
<td>74</td>
<td>47.1</td>
<td>0.64</td>
</tr>
</tbody>
</table>

The RPPU column is the processor utilization multiplied by the relative processor power (RPP) of the processor and adjusted using the capture ratio. The formula is:

\[
RPPU = \frac{CPU \times RPP}{100 \times CR}
\]

Because the RPPU is independent of the processor, you can use it when combining workloads from different machines.
Table 4. Work running on SYS2

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Processor usage from RMF (CPU)</th>
<th>Capture ratio (CR)</th>
<th>Relative processor power used (RPPU)</th>
<th>I/O count from RMF (IO)</th>
<th>Relative I/O content (RIOC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CICS2</td>
<td>3.3%</td>
<td>0.43</td>
<td>94.3</td>
<td>19.1</td>
<td>0.20</td>
</tr>
<tr>
<td>IMS2</td>
<td>0.1%</td>
<td>1.00</td>
<td>1.2</td>
<td>0.4</td>
<td>0.33</td>
</tr>
<tr>
<td>TSO2</td>
<td>14.7%</td>
<td>0.51</td>
<td>354</td>
<td>111</td>
<td>0.31</td>
</tr>
<tr>
<td>BATCH2</td>
<td>32.0%</td>
<td>0.79</td>
<td>498</td>
<td>289</td>
<td>0.58</td>
</tr>
</tbody>
</table>

If you have to plan the capacity for this work, you must first predict the growth for each workload. Capacity Planner can help by calculating the historical growth, but remember that forecasts calculated from historical data serve as a rough guide only. Table 1 on page 34 shows an example.

Table 5. Predicted percentage growth per workload

<table>
<thead>
<tr>
<th>Workload</th>
<th>Interval 0</th>
<th>Interval 1</th>
<th>Interval 2</th>
<th>Interval 3</th>
<th>Interval 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CICS2</td>
<td>1.00</td>
<td>1.05</td>
<td>1.05</td>
<td>1.05</td>
<td>1.05</td>
</tr>
<tr>
<td>IMS2</td>
<td>1.00</td>
<td>1.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TSO2</td>
<td>1.00</td>
<td>1.15</td>
<td>1.20</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>BATCH2</td>
<td>1.00</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
</tr>
<tr>
<td>CICS1</td>
<td>1.00</td>
<td>1.10</td>
<td>1.20</td>
<td>1.10</td>
<td>1.10</td>
</tr>
<tr>
<td>IMS1</td>
<td>1.00</td>
<td>1.05</td>
<td>1.05</td>
<td>1.05</td>
<td>1.05</td>
</tr>
<tr>
<td>TSO1</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>BATCH1</td>
<td>1.00</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
</tr>
<tr>
<td>DB2</td>
<td>0</td>
<td>1.00</td>
<td>5.00</td>
<td>1.20</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Interval 0 represents the current time, the base month in Capacity Planner terminology. An interval is a period of time that you have chosen, such as six months. Notice the new work—DB2. You must fit this new application beside the other work. Notice also that IMS2 disappears in interval 2.

Simple projection for SYS2

In the simplest case, you can make a projection by applying the growth factors in Table 1 on page 34 to the values in Table 4. Table 6 shows the result.

Table 6. Simple projection for SYS2

<table>
<thead>
<tr>
<th>Interval</th>
<th>RPPU</th>
<th>Utilization in %</th>
<th>DASD I/O rate in I/Os per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (total)</td>
<td>948</td>
<td>77</td>
<td>420</td>
</tr>
<tr>
<td>1 (CICS2)</td>
<td>99</td>
<td>(99/1229) × 100</td>
<td>99 × 0.2</td>
</tr>
<tr>
<td>1 (IMS2)</td>
<td>1.2</td>
<td>(1.2/1229) × 100</td>
<td>1.2 × 0.33</td>
</tr>
<tr>
<td>1 (TSO2)</td>
<td>407</td>
<td>(407/1229) × 100</td>
<td>407 × 0.32</td>
</tr>
<tr>
<td>1 (BATCH2)</td>
<td>548</td>
<td>(548/1229) × 100</td>
<td>548 × 0.58</td>
</tr>
<tr>
<td>1 (total)</td>
<td>1055</td>
<td>86</td>
<td>468</td>
</tr>
<tr>
<td>2 (total)</td>
<td>1195</td>
<td>97</td>
<td>526</td>
</tr>
</tbody>
</table>
Table 6. Simple projection for SYS2 (continued)

<table>
<thead>
<tr>
<th>Interval</th>
<th>RPPU</th>
<th>Utilization in %</th>
<th>DASD I/O rate in I/Os per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (total)</td>
<td>1260</td>
<td>103</td>
<td>562</td>
</tr>
<tr>
<td>4 (total)</td>
<td>1332</td>
<td>108</td>
<td>601</td>
</tr>
</tbody>
</table>

Table 6 on page 36 separates the types of work in interval 1, for clarity. The RPPU in Table 4 on page 36 is multiplied by the workload growth for the interval, from Table 1 on page 34. In the case of CICS2, for example, the new RPPU is:

\[ 94.3 \times 1.05 = 99 \]

The utilization is the RPPU divided by the relative processing power of the 3090-200, which is 1229. The DASD I/O rate is the RPPU multiplied by the relative I/O content (RIOC) for that type of workload, from Table 4 on page 36.

You must reduce the work on SYS2, because the utilization is unacceptably high. Consider removing CICS2.

Removing some work from SYS2

Table 7 shows the effect of removing CICS2:

Table 7. Removing CICS2 from SYS2

<table>
<thead>
<tr>
<th>Interval</th>
<th>RPPU</th>
<th>Utilization in %</th>
<th>DASD I/O rate in I/Os per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (total)</td>
<td>948</td>
<td>77</td>
<td>420</td>
</tr>
<tr>
<td>1 (CICS2)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 (IMS2)</td>
<td>1.2</td>
<td>((1.2/1229) \times 100)</td>
<td>(1.2 \times 0.33)</td>
</tr>
<tr>
<td>1 (TSO2)</td>
<td>407</td>
<td>((407/1229) \times 100)</td>
<td>(407 \times 0.32)</td>
</tr>
<tr>
<td>1 (BATCH2)</td>
<td>548</td>
<td>((548/1229) \times 100)</td>
<td>(548 \times 0.58)</td>
</tr>
<tr>
<td>1 (total)</td>
<td>956</td>
<td>78</td>
<td>447</td>
</tr>
<tr>
<td>2 (total)</td>
<td>1091</td>
<td>88</td>
<td>505</td>
</tr>
<tr>
<td>3 (total)</td>
<td>1151</td>
<td>94</td>
<td>540</td>
</tr>
<tr>
<td>4 (total)</td>
<td>1218</td>
<td>99</td>
<td>578</td>
</tr>
</tbody>
</table>

This does not help very much. The utilization is still uncomfortably high. Table 2 on page 34 shows a historical peak-to-average ratio of 1.45 for SYS2. Therefore, latent demand occurs at peak times when the average utilization exceeds 70%.

Now see the effect of upgrading the processor.
Upgrading the processor for SYS2

Upgrading the processor affects only the utilization column. The RPPU, a measure independent of the system, does not change. Nor does the DASD I/O rate. Table 8 shows the effect of an upgrade to a 3090-300S, with a relative processing power of 2482.

Table 8. Upgrading the SYS2 processor

<table>
<thead>
<tr>
<th>Interval</th>
<th>RPPU</th>
<th>Utilization in %</th>
<th>DASD I/O rate in I/Os per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (total)</td>
<td>948</td>
<td>77</td>
<td>420</td>
</tr>
<tr>
<td>1 (CICS2)</td>
<td>99</td>
<td>(99/2482) × 100</td>
<td>99 × 0.2</td>
</tr>
<tr>
<td>1 (IMS2 )</td>
<td>1.2</td>
<td>(1.2/2482) × 100</td>
<td>1.2 × 0.33</td>
</tr>
<tr>
<td>1 (TSO2 )</td>
<td>407</td>
<td>(407/2482) × 100</td>
<td>407 × 0.32</td>
</tr>
<tr>
<td>1 (BATCH2)</td>
<td>548</td>
<td>(548/2482) × 100</td>
<td>548 × 0.58</td>
</tr>
<tr>
<td>1 (total)</td>
<td>1055</td>
<td>42</td>
<td>468</td>
</tr>
<tr>
<td>2 (total)</td>
<td>1195</td>
<td>48</td>
<td>526</td>
</tr>
<tr>
<td>3 (total)</td>
<td>1260</td>
<td>51</td>
<td>562</td>
</tr>
<tr>
<td>4 (total)</td>
<td>1332</td>
<td>54</td>
<td>601</td>
</tr>
</tbody>
</table>

Now there is spare capacity, and you could try adding the DB2 work to this system. Your plan for the workload includes a DASD I/O rate. How do you ensure that you have enough channels, controllers, and actuators to support this I/O rate?

Planning for DASD I/O throughput

The method for DASD uses basic configurable units (BCUs), a unit of DASD with a known performance. You build your DASD configuration using these building bricks until the throughput performance (and space in gigabytes) is what you need.

Table 9 shows what each unit contains.

Table 9. BCU specifications

<table>
<thead>
<tr>
<th>BCU</th>
<th>Controller</th>
<th>Type of actuator</th>
<th>Number of channels per BCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>3380D</td>
<td>3880-3</td>
<td>3380D</td>
<td>2</td>
</tr>
<tr>
<td>3380Dc</td>
<td>3880-23</td>
<td>3380D</td>
<td>2</td>
</tr>
<tr>
<td>3380J</td>
<td>3990-2</td>
<td>3380J</td>
<td>2</td>
</tr>
<tr>
<td>3380Jc</td>
<td>3990-3</td>
<td>3380J</td>
<td>2</td>
</tr>
<tr>
<td>33902</td>
<td>3990-2</td>
<td>33902</td>
<td>2</td>
</tr>
<tr>
<td>33902c</td>
<td>3990-3</td>
<td>33902</td>
<td>2</td>
</tr>
</tbody>
</table>

You choose the type of device you want and the required response, which is a business criterion, and you can then see how many BCUs you need. See "BCU Values" on page 99 for a response-time table for common BCU types.

The I/O rates for each response time are determined by experiment. The throughput for a given response time may be different at your installation. You can use the MVSPM_DEVICE_H table, which is in the MVS performance management component of the System Performance feature, to find the response times and throughput of your DASD devices.
The I/O rate in the response-time table applies to the first BCU. Because of the statistical
distribution of I/O demand, the other BCUs have progressively less I/O capacity. See "Skew
factor" on page 34.

Use the BCU tables to make a table of your DASD configuration, first with the devices that
you have. Then add more devices at the end of the table until the total I/O capacity is
sufficient for the forecasted DASD I/O rate in Table 8 on page 38.

Table 10. DASD configuration plan

<table>
<thead>
<tr>
<th>BCU</th>
<th>Target response time in ms</th>
<th>Nominal I/O capacity in I/Os per second</th>
<th>Skew factor</th>
<th>Adjusted I/O capacity in I/Os per second</th>
<th>DASD space in gigabytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3380Dc</td>
<td>20</td>
<td>120</td>
<td>1</td>
<td>120</td>
<td>10.1</td>
</tr>
<tr>
<td>3380D</td>
<td>29</td>
<td>80</td>
<td>0.85</td>
<td>68</td>
<td>10.1</td>
</tr>
<tr>
<td>3380D</td>
<td>29</td>
<td>80</td>
<td>0.71</td>
<td>57</td>
<td>10.1</td>
</tr>
<tr>
<td>3380D</td>
<td>29</td>
<td>80</td>
<td>0.53</td>
<td>42</td>
<td>10.1</td>
</tr>
<tr>
<td>3380E</td>
<td>30</td>
<td>80</td>
<td>0.44</td>
<td>35</td>
<td>20.2</td>
</tr>
<tr>
<td>3380E</td>
<td>30</td>
<td>80</td>
<td>0.44</td>
<td>35</td>
<td>20.2</td>
</tr>
<tr>
<td>3380E</td>
<td>35</td>
<td>101</td>
<td>0.44</td>
<td>44</td>
<td>20.2</td>
</tr>
<tr>
<td>3380E</td>
<td>35</td>
<td>101</td>
<td>0.44</td>
<td>44</td>
<td>20.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>458</td>
<td>125</td>
</tr>
</tbody>
</table>

Table 10 shows eight BCUs of three types giving a total adjusted I/O capacity of 458 I/Os
per second. This depends on a reasonable distribution of I/Os across the BCUs. If most of
this throughput is directed toward one data set, the response times in Table 10 will not be
correct—see "Constraints on growth" on page 31.

Look again at Table 8 on page 38. The configuration in Table 10 has enough capacity for
interval 0, but interval 1 requires a DASD I/O capacity of 468 I/Os per second, so you must
add BCUs to the table to give at least 10 extra I/Os per second.

With a skew factor of 0.44, the extra BCU needs a nominal rate of I/Os per second equal to:

\[
\frac{10}{0.44} = 23
\]

Any 3990 or 3880 BCU can achieve this. Decide what response time and what DASD space
you need.

There is a column in Table 10 for DASD space, but a BCU is really defined as a number of
strings and channels. The space is not fixed, because the strings can be of any length. The
DASD space column in Table 10 assumes two units per string. Capacity Planner makes no
assumption about the DASD space of each BCU. Instead, it has two tables, one with the
estimated throughput per BCU, and another with the space per DASD unit. See "BCU
Values" on page 99 and "DASD Space" on page 103.

When planning your DASD configuration, add columns in Table 10 for DASD floor space
and heat output—you may have to upgrade your computer room, too.
**How does Capacity Planner help you?**

Capacity Planner makes capacity planning much easier with its tables of BCU characteristics, skew factors, and so on. But you must make decisions and guesses, so you must understand what Capacity Planner does for you, and what assumptions it makes.

This chapter has dealt mainly with processor power and DASD I/O throughput, but the method is the same for processor storage and DASD space.

Here is a summary of the capacity planning process:

1. **Get the data, as in Table 3 on page 35.**
   - Capacity Planner downloads the data from Performance Reporter. Remember: Capacity Planner does not judge latent demand—you must decide if latent demand exists on your processor.

2. **Use Capacity Planner to determine the capture ratios for each workload.**

3. **Estimate the rate of growth for future intervals.**
   - Capacity Planner divides growth into two types: steady growth and steps in demand.
   - Specify steady growth as trend values, and steps in demand as plan values. Capacity Planner can help by calculating the historical growth, but check for the different causes of growth described in "Causes of increased demand" on page 33.

4. **Make a plan for each resource in turn.**

5. **Print the plans and show them to management.**
   - A plan that can be translated into expenditure is likely to provoke more discussion—exactly what you want.
Managing Data on the Workstation

This chapter explains how to download data, and how data and parameters are stored on your workstation.

Downloading data

The administrator must customize the Performance Reporter administration dialog so that you can download data from TSO. This chapter assumes that Performance Reporter has been customized for Capacity Planner. On your workstation, Communications Manager should be configured so that you can start a 3270 emulator session with the OS/390 system that has your Performance Reporter database.

Preparing TSO

Open the 3270 emulator session and log on to TSO. Access the administration dialog main window, which is shown in Figure 20.

![Figure 20. Administration Dialog main window](image)

Select the Workstation interface option on the Utilities menu. Figure 21 on page 42 shows the window.
If you see the error message about a split screen, close the other ISPF logical screen so that the workstation interface window is the only logical screen, or make sure that there is only one input field on the physical screen.

You can now minimize the emulator session window. TSO is now ready to accept download requests from Capacity Planner.

When you have finished using the workstation dialog, return to the emulator session and leave the interface window.

Starting Capacity Planner

This topic assumes that you have installed Capacity Planner in the directory \DRLCP. Follow these steps:

1. Open an OS/2 window.
2. Make \DRLCP the working directory, and create a subdirectory for your own data:
   
   ```
   cd \drlcp
   md test
   ```
3. Start Capacity Planner:
   
   ```
   drlcp
   ```

   You can also start the application by selecting it from a folder or group if you have included it in a folder or group as described in “Completing the installation” on page 23. The main window in Figure 22 on page 43 is displayed.
Notice the menu bar with its choices of File, Parameters, Reports, Settings, and Help. When you select one, the associated menu is displayed. Take some time to study the pull-down menus. At this stage, most of the menu choices are unavailable (not highlighted) because no profile has been loaded.

4. Select the Settings menu and Host sessions. Specify the name of the 3270 emulator session that you are using to transfer files.

5. Select File by clicking on it. The File menu is displayed in Figure 23. If you do not use a mouse, use the equivalent keyboard action described in “Using a Keyboard” on page 89.

6. Select Download. A message will ask you to confirm that you want to start downloading data.
7. Select OK. The Path window showed in Figure 24 is displayed; here specify the directory for the downloaded data.

8. Scroll down the Directory list box until you see the \DRLCP directory, and double-click on it. The directory name moves to the Selected path field, and its subdirectories appear in the Directory list box. The DEMO subdirectory is displayed—do not download data into this directory, or you will lose the demonstration data that is used in “Using Capacity Planner” on page 51.

9. Double-click on the test subdirectory that you created in step 2.

10. Select OK. Capacity Planner starts downloading data, file by file. The Download Progress window appears, displaying how much data is being downloaded.

11. When all the data has been downloaded, the Download Progress window disappears.

12. Return to the emulator session and leave the interface panel using Exit (F3).

**What to do if you have problems**

If data is not transferred correctly, follow these steps to diagnose the problem:

1. Select option 4 (Tables) in the Administration dialog.

2. Scroll to the Capacity Planner tables that begin with CP_.

3. Check that a table contains data selecting it and pressing F11 (Display).

4. If data exists in the tables, the problem probably lies with the interface. Check that you can transfer any data over the emulator session with the OS/2 RECEIVE command. This command does not use the EHLLAPI routines, so a successful transfer using RECEIVE indicates a problem with the EHLLAPI. Follow the instructions in “Using the communications manager trace” on page 45.

5. Look at the WIFMSG data set (CPLUSER.DRLOUT), which contains a trace of the SQL commands used to produce the failing report.
Using the communications manager trace

To take a trace:

1. Select the Advanced menu on the Communications Manager window.
2. Select Problem determination aids.
3. Select Trace services.
4. On the Trace services window, select Select traces.
5. Select Trace selections, and set the trace record length to zero.
6. Select EHLLAPI.
7. Return to the Trace services window, and select Start selected traces.
8. Leave the Communications Manager window.
9. Attempt to transfer data.
10. Return to the Communications Manager window.
11. On the Trace services window, select Stop traces.
12. Select Copy storage trace to file.
13. Specify a file name and press Enter.
14. Examine the resulting trace file. Figure 25 on page 46 shows an example. Refer to OS/2 Extended Edition V1.3 Programming Services and Advanced Problem Determination for Communications or, for OS/2 Version 2, Extended Services for OS/2 Programming Services and Advanced Problem Determination for Communications.
Problems with inconsistent data

If you get the message DRL3235E, which informs you that the downloaded data does not match the data in the CP_PROCESSOR lookup table, do the following:

1. Check that CP_PROCESSOR and CP_WORKLOAD_TYPE both contain the same system IDs, and that no system IDs are missing from either table.

2. The downloaded CP_WORKLOAD_TYPE table is DRLCR.DAT. The downloaded CP_PROCESSOR table is DRLPROC.DAT. These are normal ASCII files, so you can bypass the problem by using an editor to add missing system IDs.

3. To prevent a recurrence of the problem, change CP_PROCESSOR and CP_WORKLOAD_TYPE so that both have a complete list of system IDs.

Where is the data?

You probably noticed that the application did not prompt you for a file name for the downloaded data. Capacity Planner downloads all the data it needs into files with predefined names. The file extension of all these files is DAT.

Because the names of these files are fixed, you cannot have more than one set of data files in a directory. To work with different sets of data, you must use Capacity Planner with different directories.
Profiles

A profile is a text file that contains sets of parameters that can be used by Capacity Planner. Because you can choose any name for a profile, you can have many sets of parameters in your data directory. You must give each profile a file extension of PRO.

Figure 26 shows the files that Capacity Planner uses.

![Diagram of files used by Capacity Planner]

For a full description of the files that Capacity Planner uses on the workstation, see “Programs and files” on page 23.

Working with Capacity Planner

Capacity Planner supports the following resources:
- Processor power
- Processor storage
- DASD I/O throughput
- DASD space.

Do not work on all the resources at the same time, because the parameters and processing are different. Use Capacity Planner as follows:

1. Download data, usually at the beginning of each month.
2. Select the first resource, processor power.
3. Create a new profile.
4. Use Capacity Planner to enter parameters and create reports.
5. Save the profile as, for example, MYPP.PRO.
6. Change to the second resource, processor storage.
7. Use Capacity Planner.
8. Save the profile as, for example, MYPS.PRO.
9. Change to the next resource, DASD I/O throughput.
10. Repeat the process for DASD I/O throughput and DASD space.

As a result you have one set of data and four profiles, one for each resource. But by changing resource after saving a profile, you can create a profile for the new resource without reentering all the common parameters, which you must do if you select Create profile each time.

After you have used Capacity Planner for a month, you will probably use your old profiles, selecting Open on the File menu after you have downloaded data, which saves time.

In this example, select processor power before creating the profile. To do this, click on the button on the main window marked Processor power. If you do not use a mouse, use the arrow keys (↑↓) to select the resource type.

Creating a profile
Create a new profile by selecting the File and the Create profile menu choices. Do this after downloading data, because Capacity Planner reads the data files when building the profile. When you create a new profile, Capacity Planner prompts you for the most important parameters:

- The default data path
- The OS/390 system that you want to report on
- The base month.

The window shown in Figure 24 on page 44 is displayed. Select the path as described in “Starting Capacity Planner” on page 42. Next, select the OS/390 system that you will work with.

Selecting the OS/390 system
Figure 27 on page 49 shows the systems for the demonstration data. For your downloaded data, the SMF IDs of your systems are displayed.
The Systems list box lists the OS/390 systems that are referenced in the downloaded data. Select the system or systems that you want to report on. (This does not prevent you from changing your mind later and selecting different systems.)

You may want to select several systems when using Capacity Planner to predict the effect of moving work from one system to another. That is why you can specify, for each selected system, its relative internal throughput rate (ITR). For single-system reporting, though, select only one system from the list box. Capacity Planner makes the selected system the reference system, too, although this field is used only when working with multiple systems.

How to use this window to report on more than one system is explained in the relevant topic:

Transfer of work between OS/390 systems
See “Combining Work from Several Systems” on page 77.

PR/SM and VM reporting
See “Reporting on PR/SM and VM Complexes” on page 83.

For example, if you first want to analyze the MVS system 1692 (1692 is the SMF ID), select the row 1692 in the list box. Select it by clicking on it or by using the arrow keys (↑↓) and the space bar. This is an example of a list box where you can select more than one row—pressing the space bar once you select a row and pressing it again you deselect it. Then select OK to leave the window.

Selecting the base month
When you have selected the system, the window in Figure 28 on page 51 is displayed.
Select the base month and the actual month on this window. The base month is the month to be analyzed for the capacity planning, storage adjustment, and base month usage reports. For the forecast and trend-and-plan reports, it is the last month of data used—Capacity Planner calculates the figures for the month after the base month and later months.

The actual month is used only in trend-and-plan reports. Capacity Planner calculates the growth after the base month, but shows the real (historical) figures after the base month up to the actual month alongside the calculated figures, so that you can compare the forecasted and actual values. So the actual month must always be later than or equal to the base month.

For most purposes, set both the base month and the actual month to the last month for which there is full and reliable data. You can select any month for which there is downloaded data.

**Saving the profile**

The profile contains your parameters such as trend and plan values. Save the profile:

- At intervals, if you are making many changes to parameters
- Before changing the resource type
- Before finishing your work with Capacity Planner.

To save a profile, do the following:

1. From the File menu, select Profile description.
2. In the corresponding field, give a meaningful description to your profile.
3. From the File menu, select Save to save the profile.
Using Capacity Planner

This chapter uses the demonstration data supplied with Capacity Planner to introduce you to most of the features of the dialog. Work through this chapter before using data from your Performance Reporter database. See also “Extracts from Online Help” on page 91.

Start the application as described in “Managing Data on the Workstation” on page 41. Notice the available resources:
- Processor power
- Processor storage
- DASD I/O throughput
- DASD space.

Planning for the different resources

Make a plan for each of these resources in turn. The method is similar in each case, although each resource has its own parameters. For example, when making a plan for DASD I/O throughput, specify the number and type of your I/O devices.

From the main application window, as shown in Figure 22 on page 43, click the first resource, Processor power, and then click File on the menu bar. The menu showed in Figure 23 on page 43 is displayed.

Creating a profile

For information about profiles and downloading data, see “Managing Data on the Workstation” on page 41. Use demonstration data for this exercise, so you need not download data. Create a profile by selecting Create profile. You can select it in one of the following ways:
- Type the letter of the choice that is underlined (C for Create profile).
- Use the cursor-movement key or tab key to move the cursor to Create profile, and press Enter.
- Click on the words Create profile.

The Path window is displayed, but you can also select it from the Settings menu.

Setting the path for data

To get help with a particular field, tab to it and press F1. The help information appears in a separate window, as shown in Figure 29 on page 52.
To return to the Path window, click on any part of it.

You can return to the previous help information by selecting Options from the menu bar on the help window and selecting Previous. Or select Viewed pages to see all the help information that has been displayed.

The installation program default is \DRLCP\DEMO.

The directory specified in the Path window takes precedence over the working directory—the directory that was current when Capacity Planner was started.

**Note:** The directory specified in the Path window does not become the working directory.

The Systems window appears, followed by the Time Reference window. You must specify the parameters when you create a profile, because there are no defaults. To change the parameters of a profile, use the Parameters menu to display the Systems and Time Reference windows.

**Setting the OS/390 system**

Figure 27 on page 49 shows the Systems window. Use it to specify what system to analyze. Select just one system now—1794, and ignore the Internal throughput rate (ITR) list box and the Reference system field.

**Setting the base month**

Figure 28 on page 50 shows the Time Reference window. Use it to specify which month to analyze (the base month).
The other date on this window is the actual date, the last month for which data is available. If the base date is October and the actual date is November, trend-and-plan reports use the data for October and calculate a value for November. The actual value for November appears as a cross on the report beside the calculated value, but is not included in the growth calculation.

Set both base month and actual month to July 1994, and click OK.

You have now created an in-storage profile. The information area at the bottom of the window displays the message Active profile: UNNAMED.PRO. Choose a name when you save it.

**Looking at the base month**

Select the Reports menu and select Base month usage. Select Workload types on the cascaded menu.

![Figure 30. Division of workload for the base month](image)

Figure 30 shows processor utilization on the selected system, 1794. This chart is useful when you are adjusting capture ratios, because you can see what activity has the greatest impact on the total.

The menu bar on the main window has a new item—Resources. When the report window occupies the main window, you can use the Resources menu to change the resource type.

**Adjusting capture ratios**

The next task is to check that the capture ratios are correct. To do this, select Reports and Capture ratios. The graph shown in Figure 31 on page 54 appears.
The graph shows the RMF processor utilization figures for the selected base month, July 1994, weighted by the capture ratios. If the capture ratios are accurate, the utilization for the whole machine should lie within the dashed lines. For information about how Capacity Planner produces this chart, see "Calculating the capture ratio" on page 106.

Notice first what system is being analyzed. The data from the Performance Reporter database can be from more than one system, and the one selected (1794) is shown under the x-axis.

To adjust the capture ratios do the following:
1. Select the Parameters menu, shown in Figure 32 on page 55.
Tip: The available option in the Parameters menu depends on the currently selected resource. In Figure 32, the currently selected resource is Processor Power.

2. From the Parameters menu select Capture ratios. The Capture Ratios window opens showing the capture ratio for each workload type, as in Figure 33 on page 56.
The calculated total utilization is greater than the total utilization measured by RMF, so the capture ratios must be increased. The smaller the capture ratio, the more the RMF measurement must be increased to allow for the uncaptured part—here the RMF measurements have been increased too much.

3. Increase the STC (started task) value, for example, by 5%:
   a. Select the row STC. The value, 60, appears in the Capture ratio field under the list box.
   b. Change this value to 64.
   c. Press Enter.
   d. Save this value. Click OK. If you do not use a mouse, tab to OK and press Enter.

   Capacity Planner redisplays the graph, and you can see whether the total utilization now lies within acceptable limits. You should always calculate the capture ratios for the base month. Capture ratios change, especially when the machine is heavily loaded, or when the operating system is upgraded.

4. Save your capture ratio values:
   a. From the File menu, select Save as.
   b. In the displayed dialog, select the directory \DRLCP\DEMO.
   c. Type the name DEMOPP.PRO in the Profile field. (PRO is the extension for profiles and PP stands for processor power—you will have a profile for each resource type.)
d. Click OK.

When you have adjusted the capture ratios for the data on your systems, consider changing the default capture ratios in the Performance Reporter lookup table CP_WORKLOAD_TYPE. See “Updating workload types” on page 14. To change the default capture ratios:

1. Save the capture ratio report. This is useful if you will present your capacity plan at a meeting, or if you want to print it.
2. Select the Report menu and select Save as metafile. Specify the filename REPORT1.MET. The file extension is normally MET for metafiles.

Your report is saved in a metafile format. This is a standard format that you can export from OS/2. OS/2 provides these utilities for processing metafiles:

**OS/2 1.3**
Use the Print and Display Picture utilities in the Utilities group.

**OS/2 Version 2**
Use the Picture View utility in the Productivity folder.

You cannot overwrite a file when saving a metafile. If you run this practice session again, delete REPORT1.MET first, or choose another name.

### Making a forecast

Now, make a forecast of the growth of each workload type. First select a planning interval, the interval of time used in calculations.

#### Setting the planning interval

Select Planning interval on the Parameters menu. This parameter is used for all forecasts, and is Capacity Planner’s unit of time. For example, a trend value of 5% specifies a growth of 5% in each planning interval. This corresponds to an annual growth of 10.25% if the planning interval is half a year and the forecast type is exponential. Because there is this close relationship between the planning interval and other parameters, set the planning interval first, and be careful not to change it without considering the effect on other parameters.

For this practice session, select a planning interval of a half year.

#### Displaying the forecast

Unlike the base month report, where all workload types are shown, the forecast report is for one workload type at a time. To select a workload for the forecast:

1. Select Active workload type on the Parameters menu. The Active Workload Type window shows the workload types that are defined in the Performance Reporter lookup table CP_WORKLOAD_TYPE for the selected systems.

   CP_WORKLOAD_TYPE is downloaded to the workstation file DRLCR.DAT is displayed.
2. Select TSO.

3. Select OK.

4. Select Reports and Forecasting. A cascaded menu is displayed; here select the type of forecast.

5. Select CPU utilization. Now choose between reporting on a workload type or an application. A workload type is a set of OS/390 performance groups defined to Performance Reporter in the lookup table CP_WORKLOAD_TYPE. If instead, you want a different grouping of performance groups, define applications using Applications on the Parameters menu. For this practice session, use the predefined workload types, which are shown in Figure 34.

6. Select Workload type. The forecast in Figure 35 on page 59.
The first part of the line passes through crosses. These crosses represent measured data. The forecasting starts at the base month, which you specified on the Time reference window.

The report shows the calculated growth as a percentage for the planning interval, and a correlation figure showing how well the line fits the measured data. This correlation is 1.0 for a perfect fit, where all crosses lie on the line. The more random the crosses, the lower the value.

Get the growth rate for other workload types:
7. Select a different active workload type.
8. Select OK. Capacity Planner refreshes and redisplays the forecast.
9. Repeat this procedure for each workload type.

Your next question should be: Is the calculated growth of any use in predicting demand?

Adding trend and plan values

So far Capacity Planner has calculated the expected growth for each workload type, based on the data for the peak hours. (Assume for the sake of this discussion that Capacity Planner is using your data). This is the first step in your plan. You know much more than Capacity Planner about your business plans, so ask yourself these questions:

- Was there anything in the data that caused an unusually large or small growth? Perhaps an application was moved to a different system, or from a different system to the one under investigation.
- Was there enough data to make the forecast statistically significant? You can use the correlation figure as a guide here.
What are the business plans for the next year? Perhaps there will be new applications or a new batch of terminals. See "Causes of increased demand" on page 33 for possible reasons for growth.

Has there been a processor upgrade? SMF measures the average number of seconds that the processor is busy. For example, TSO may use 1000 processor-busy-seconds in one day, meaning that if all its processor time were added together, it would use the processor for 1000 uninterrupted seconds. If the processor is upgraded to a faster model, SMF will measure fewer than 1000 processor-busy-seconds for the same amount of work. So a processor upgrade can result in a downward step in the data.

At this point, talk to application developers and user groups to find out what they are planning. They should take the time to give you accurate information. With this data and the results of the forecast, you can continue with the capacity plan.

From your meetings with users and developers, and from your forecasts, you have some estimates of the growth of work. This is a combination of steady growth throughout the year and steps in load, depending on the cause of the growth.

Select the Reports menu, Trend and plan, and Workload types. This trend-and-plan report shows the forecast with zero growth, the default. The historical growth, which is shown on the forecast reports, is not shown on the trend-and-plan reports. The growth on the trend-and-plan reports comes only from the parameters in the profile and the values for the base month. The data for earlier months is not used.

**Supplying trend values**

Specify your estimate of the steady growth:

1. Select the Parameters menu.

2. Select Trend values and Workload types. On the Workload Trend Values window, a list of workload types with the trend values is displayed.

In this practice session, set just one trend value, 20%, for DB2:

3. Select the DB2 row by clicking on it. The trend value, zero, moves to the Trend value field below the list box.

4. Overtype this value with 20.

5. Press Enter.

If you are specifying values for more than one workload type, select the next row and change the trend value in the same way. When you have changed all the trend values, select OK to save the values in the in-storage profile.

The trend value is the percentage increase for each planning interval. So do not specify an annual growth if the planning interval is half a year. You can enter a negative value to show a decrease in load. Use the forecasted growth value or a revised figure based on your discussions with user groups.

6. Select OK to save the 20% trend value for DB2.

7. Select the Forecast type window on the Parameters menu.

8. Specify a linear growth (the default). If you select a linear growth, 20% of the base month value is added every planning interval; but if you select exponential growth, the value for any planning interval is an increase of 20% over the previous interval.
Now add data representing steps in workload for the coming year, the plan values.

**Supplying plan values**

Plan values represent planned changes in your workload, rather than steady growth. To specify a plan value do the following:

1. Select the Parameters menu, Plan values, and Workload types.
   
   On the first Workload Planning window specify the workload type and the planning interval that you want to specify the values for. For example, if the base month is July and the planning interval is half-yearly, there are two planning intervals in the first year: August to January, and February to July.

2. Specify CICS (click the row) in the Workload type list box.

3. Specify the first half year in the Interval list box.

4. Select the Define button. The window shown in Figure 36 is displayed.

![Workload Planning Window](image)

**Figure 36. Specifying plan values**

The second Workload Planning window shows the values for the base month—the utilization per job and the average number of concurrent jobs (or TSO users) in the peak hour. If the utilization is small, it is shown in scientific format, 6.86e-002. This means:

\[ 6.86 \times 10^{-2} = 0.0686 \]

Use the Number and CPU% fields like this:

- **Batch** Estimate the increase in batch job streams (busy initiators) in your peak period. Type the processor utilization of each extra busy initiator in the CPU% field.
**TSO**
Estimate the increase in the number of TSO users logged on in the peak period. Type the processor utilization of each extra TSO user in the CPU% field.

**CICS and IMS**
Type 1 in the Number field. This is not really an extra job—you are specifying the extra load as though it were an extra job. Type the *increase in processor utilization* in the CPU% field.

For this practice session, follow these steps to specify a plan value for CICS:

1. Select the row marked New.

2. In the Number field, type the expected increase in jobs in the chosen planning interval (the first half year after the base month). For CICS, type 1.

3. In the CPU% field, type the expected increase. Suppose that you expect your CICS system to grow from 20% to 21.5% in the half year. Type 1.5 in the field. Remember that planned growth is in addition to any steady growth specified as a trend value for the same workload type.

4. Select Add. (You select Subtract to specify a reduction in utilization.)

5. Press Enter.

6. If you want to specify another plan value for the same workload type and interval, repeat steps 1 through 5.

7. If you want to change the value that you have entered, select the row in the list box and repeat steps 2 through 5.

8. Select OK to save the plan values in the in-storage profile. When you create a plan, specify plan values for the second half year and for other workload types in the same way.

9. Leave the Workload Planning window; select OK.

To see the report with your trend and plan values do the following:

1. Select Reports, Trend and plan, and Workload types. The report shown in Figure 37 on page 63 is displayed.
2. Select the Type menu.

3. From the Type menu, select a table chart. This changes the report to a table format, with numeric values.

   Now save the report. You cannot save a table chart as a metafile, because it is not a graphic report; but you can select Print, or you can copy selected lines of the report to the OS/2 clipboard by selecting Copy on the Report menu. If you have a printer, try printing the report:

4. Select Print on the Report menu to send the report to the default printer. Select Printer properties to change the printer-dependent properties such as page orientation (the variables depend on the device driver for the printer).

5. Save the profile. Select File and Save.

Your report base month is July 1994. This implies that you have data up to and including this month. However, you can tell Capacity Planner to begin the forecast earlier than this. For example, if the data for July is incomplete or unreliable, the forecast should start in June.

Because the intervals are relative to the base month, changing the base month can change the interval in which the plan value falls. Figure 38 on page 64 shows an example:

- The base month is January 1994.
- You have 3-month planning intervals.
- You plan a change on 10 May 1994, so you specify a plan value for the second quarter, marked with a ♦.
- You change the base month to February 1994.
You must move the plan value to the first quarter.

### Planning for processor storage

So far, you have produced a plan for the growth in workload and its consequent demand for processor power. Now use Capacity Planner to estimate the processor storage required for the same growth in workload.

As a first approximation, you can guess this from the plan for processor power. If you need 10% more power in the coming year, you can guess that you also need 10% more central storage and expanded storage. However, the application that grows the most might be a processor-intensive program that uses little storage. You might need no extra storage at all. Capacity Planner considers the characteristics of each workload when calculating the requirements for each resource.

To plan for processor storage do the following:

1. **Select the Processor storage resource.** What about the profile? As explained in “Profiles” on page 47, you should have a separate profile for each resource, but you save time by deriving one profile from another. You have the processor power profile DEMOPP.PRO in storage. Many of the parameters are equally valid for processor storage, so change those that are different and then save the profile as DEMOPS.PRO. When you add planning data, have separate profiles for each type of processor storage—one for central storage and one for expanded storage.

2. Select the Parameters menu and Systems.

3. Select system 1794.

4. Select OK. Besides confirming the system, this window has another important function—it causes Capacity Planner to read the data and to load lists of workloads and

---

**Figure 38. Changing the base month**

<table>
<thead>
<tr>
<th>Effect of changing the base month</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
</tr>
<tr>
<td>Base month: January 1994</td>
<td></td>
</tr>
<tr>
<td>First quarter</td>
<td></td>
</tr>
<tr>
<td>Second quarter</td>
<td></td>
</tr>
<tr>
<td>Base month: February 1994</td>
<td></td>
</tr>
<tr>
<td>First quarter</td>
<td></td>
</tr>
<tr>
<td>Second quarter</td>
<td></td>
</tr>
</tbody>
</table>
storage classes into the profile. Here, there is no change, but it is a sensible precaution to select the system—you might otherwise create trend values for a workload that there is no data for.

5. Select the Parameters menu and Time reference.


7. Select OK.

8. Create the forecast in the same way as for processor power, by selecting Reports, Forecasting, Processor storage, and Workload type.

9. Change the active workload type and see the different forecasts for each selected workload. Notice that the growth figures for each workload are different from those for processor power, showing that the workloads are not equally processor intensive and storage intensive.

10. Select Base month usage and Workload types from the Reports menu. You see the report in Figure 39.

   ![Figure 39. Base month usage report for central storage](image)

   This report shows how much central storage is used in the base month. It shows the storage used for the system area, SYS-AREA, and for the private regions of each workload type.

Now see how much expanded storage is used:

11. Select Processor storage type on the Parameters menu.

12. Select Expanded storage.

13. Select OK.
If this were not a practice session, you would specify your estimated trend and plan values for each workload after discussing application growth with users. The profile, which you derived from the processor power profile, already contains trend values. However, the plan values were zeroed when you changed resource type, because plan values for processor storage are in units different from those for processor power.

To add a plan value for this practice session do the following:

14. Select Processor storage type on the Parameters menu.
15. Select Central storage.
16. Select OK.
17. Specify a plan value of an extra 5MB for CICS for the first planning interval. Specify this in the same way as for processor power.
18. Select the Reports menu, Trend and plan, and Workload types to see the report that results from this plan value. This trend-and-plan report is shown in Figure 40.

To save your plan for central storage:

19. Select File and Save as.
20. Save the central storage profile as DEMOCS.PRO.
21. Switch to expanded storage by selecting Processor storage type on the Parameters menu. A message warns you to check your plan values. Plan values for central storage are not valid for expanded storage.
22. Revise the plan value for CICS—specify 50MB instead of 5MB.
23. Save the expanded storage profile as DEMOES.PRO.
Using storage adjustment reports

Two reports estimate the paging and page movement rates for the base month for different values of central storage and expanded storage. A useful forecast depends on having data from a system that is not too storage constrained.

Select the Parameters menu, Configuration, and Processor storage to change the amount of central and expanded storage.

![Processor Storage](image)

Figure 41. Altering processor storage

Select the Reports menu and storage adjustment. The page movement rate and paging rate reports show the estimated effect of the storage change that you specify in Figure 41.

For details of how Capacity Planner estimates the effect of increased storage, see “Variation of paging rate with storage” on page 109 and “Variation of page movement rate with storage” on page 109.

Planning for DASD I/O throughput

Analyzing I/O throughput has much in common with processor power, because both use the growth in processor utilization for forecasting. Capacity Planner calculates a factor called the relative I/O content (RIOC) from the historical data and multiplies the forecasted processor utilization by this factor to find the required I/O throughput. For the RIOC calculation, see “I/O throughput by workload type” on page 109. The use of the RIOC as a constant assumes that processor utilization and I/O throughput are proportional, which is approximate at normal loads. Heavy paging can invalidate this assumption—one reason why your system should not be storage constrained.

You can save time by starting with the processor power profile when you plan for DASD I/O throughput, because these resource types have the same trend and plan values.

1. Select File and Open on the main application window.
2. Open the profile DEMOPP.PRO that you saved earlier.
3. Select the resource type DASD I/O throughput.
4. Select system 1794.
6. Produce forecasts in the same way as for processor power. You need not recalculate capture ratios because the same values are used as for processor power.
7. Select Base month usage and Workload types on the Reports menu, and the report shown in Figure 42 will be displayed.

![Tivoli Performance Reporter Capacity Planner](image)

Figure 42. Base month usage report for I/O throughput

8. Select the Reports menu, Trend and plan, and Workload types. The trend and plan values are those that you specified for processor power. The report shows the required I/O throughput.

Now you must find out what DASD configuration can give you this throughput. Capacity Planner has a configuration dialog for DASD I/O throughput that helps you.

**Using the configuration reports**

Build your configuration by adding basic configurable units (BCUs). For a description of BCU, see “Planning for DASD I/O throughput” on page 38. Use Capacity Planner to specify how many units you have of each model, and the required response time for each. The required response time depends on the most demanding service level objective of the applications needing to do I/O to that BCU.

For example, you have a CICS transaction that needs 90% of response times to be less than 0.5 seconds. Allowing for processing time and network time, which you can measure, you find that the maximum time allowable for I/O is 150ms. You know what data sets the application uses (do not forget to include system data sets such as the system log), and how many I/Os there are, on average. Suppose the list is:

- System log
- Temporary storage (one read and one write)
VSAM KSDS (one random read)
VSAM KSDS (one insert).

The number of I/Os here depends on the buffering, especially for VSAM, and the number of levels of index. But the previous list could easily result in seven I/Os, without considering the possibility of:
- Paging
- Control-interval or control-area splits
- Program fetch
- Auxiliary trace.

Assuming seven I/Os, you need a response time of 21ms or better, because $7 \times 21$ gives a total time of 147ms, just less than the target of 150ms.

As a capacity planner, you need not know every CICS transaction in detail. But you should have access to CICS performance records, which give the necessary information about each transaction. When it comes to managing data set allocation, use DFSMS classes to restrict data set allocation on high-performance disks to applications that need it.

**Analyzing your configuration**

Figure 43 shows fourteen channels, three 3880 controllers, and two 3990 controllers. The diagram does not show alternative paths or individual devices on each string—this is not relevant to analysis by BCU.

![Figure 43. Sample DASD configuration](image)

Now look at the table of BCUs in “BCU Values” on page 99. This table shows the experimentally determined I/O capacity for a range of response times. The 33902 devices have better response time, so reserve one of these BCUs for applications such as CICS, where response time is more important.

How many BCUs are there in Figure 43? As Table 9 on page 38 shows, a set of 3380J devices with two channels is one BCU, and a set of 33902 devices with four channels is two BCUs. So the diagram has seven BCUs.

What is the throughput? You could use “BCU Values” on page 99 to calculate this, but using Capacity Planner is easier:

1. Select the Parameters menu, Configuration, and I/O throughput.
2. On the I/O Throughput window, select the Add button.

3. On the Add BCU window, select a combination of DASD type and response time, and specify the number of BCUs that have this combination.
   a. Click the arrow at the right of the first list box to display the list of DASD types. For the first BCU, click the 3380J row.
   b. Click the arrow at the right of the Response time list box to display the list of response times for a 3380J BCU. If you are using the fastest DASD, 33902, for time-critical applications, choose a long response time for this BCU to give more I/O throughput capacity.
   c. Choose a response time of 38ms.
   d. Type 3 in the Number of BCUs field. Select OK.

4. When you return to the I/O Throughput window, select Add again to define two 33902 BCUs with the fastest response time, 16ms, and select Add a third time to define the two 33902 BCUs with a medium response time of 20ms.
   You now have seven BCUs defined, as in Figure 44.

5. Select OK to leave the I/O Throughput window.

6. Select the Reports menu, DASD Configuration, and I/O throughput. The report shown in Figure 45 on page 71 is displayed.
7. Select the Type menu in the report window to choose the tabular format of the same report.

The table in Figure 46 shows that the total capacity for this configuration is 1317 I/Os per second.
A skew factor has been applied to each group of BCUs. For the group of three 3380J BCUs, for example, the BCU table in “BCU Values” on page 99 shows a throughput in I/Os per second, equal to:

\[ 3 \times 260 = 780 \]

Capacity Planner estimates a maximum of 663 I/Os per second. For more information, see “Skew factor” on page 34.

Suppose you need a throughput of 1400 I/Os per second. Get another BCU, or upgrade the BCUs that you have, perhaps by adding cache storage to a controller. A 3380Jc (the c suffix denotes cache), for example, gives a throughput of 380 I/Os per second at 26ms response time, compared with 200 I/Os per second at 28ms for an uncached 3380J.

Remember always that you are planning for peak usage.

8. Save the profile before changing the resource type. Select File and Save as. Call the profile DEMOIO.PRO.

Planning for DASD space

Planning for DASD space differs from planning for the other resources in that the data does not relate disk space usage to workloads or applications. Instead, disk space is divided into DFSMS storage classes.

Note: You can customize Capacity Planner to report by project instead of storage class. See “Specifying the DASD storage class option” on page 13. The workstation dialog, however, always uses the text ‘storage class’.

1. Select the resource type DASD space.
2. Create a new profile by selecting File and Create profile.
3. Select \DRLCP\DEMO for the path.
4. Select the system 1794.
6. Select Active storage class on the Parameters menu. Figure 47 on page 73 shows the storage classes for the selected systems.
7. Select the storage class for DASD space that is not defined to DFSMS, NONSMS.

Capture ratios have no meaning for DASD space reports, so start by forecasting the allocated space for each storage class:

8. Select the Reports menu, Forecasting, and DASD space. This gives a forecast for the growth in the active DFSMS storage class, shown in Figure 48.

Figure 47. DFSMS storage classes

![Figure 47. DFSMS storage classes](image)

7. Select the storage class for DASD space that is not defined to DFSMS, NONSMS.

Capture ratios have no meaning for DASD space reports, so start by forecasting the allocated space for each storage class:

8. Select the Reports menu, Forecasting, and DASD space. This gives a forecast for the growth in the active DFSMS storage class, shown in Figure 48.

Figure 48. Forecast for NONSMS space

![Figure 48. Forecast for NONSMS space](image)
The forecast shows a negative growth, showing that the DASD space is gradually being defined to DFSMS. As for the other resource types, your growth forecast depends on many factors other than historical growth, but these figures nevertheless give some guidance if the system is fairly stable.

9. Select the Reports menu, Base month usage, and Storage classes. The report shown in Figure 49 is displayed.

![Figure 49. Base month usage report for DASD space](image)

For DASD space, specify trend and plan data for each storage class, not for each workload.

10. Select the Reports menu, Trend and plan, and Storage classes. The plan shown in Figure 50 on page 75 is displayed, showing the DASD space that you need.
The report in Figure 50 shows you the space, in gigabytes, that you need. Now build a DASD configuration that has this capacity, starting with your current configuration:

1. Select Parameters, Configuration, and DASD space.
2. Select the Add button.
3. Select the DASD type 3380J on the Add DASD window. Assume that you have the DASD configuration in Figure 43 on page 69, with two DASD boxes on each of the six strings of DASD.
4. Specify 12 in the Number field. Remember that this is the number of DASD devices, not the number of volumes.
5. Select OK.
6. Select Add again.
7. Specify sixteen 33902 devices.
8. Select OK on the Add DASD window.
10. Select the Reports menu, DASD configuration, and DASD space. The report shown in Figure 51 on page 76 is displayed.
11. Save the profile as DEMODS.PRO.

Figure 51. DASD space for the sample configuration
Combining Work from Several Systems

After making simple projections for your production OS/390 system, you may want to ask questions such as:

- What happens if I transfer IMS to a second OS/390 system, leaving more room for CICS and DB2 growth?
- After upgrading the processor on the SYS1 system, can I transfer all but development work from SYS2, and let the system programmers use the SYS2 workstation in the evenings and at weekends?

To answer these questions, you must test the effects of moving work from one system to another. To do this, use the demonstration data as an example:

1. Select Processor power.
2. Create a new profile by selecting Create profile on the File menu.
3. On the Path window, select \DRLCP\DEMO.
4. On the Systems window, select the systems that you are combining work from. Figure 52 on page 78 shows the Systems window with the two systems 1692 and 1794 selected.
When you combine systems, you must specify the reference system. In this example, specify 1692 as the reference system, because you are considering the effect of moving work to that system. If the resource type is processor power or DASD I/O throughput, specify the internal throughput rates (ITRs). The reference system always has an ITR of 100. Give the other system or systems ITR values dependent on their processing power relative to the reference system. Use values given to you by your IBM representative to determine the relative ITR. For example, if system 1692 has an ITR of 265 and system 1794 has an ITR of 191, the relative ITR for system 1794 is

\[
\frac{191}{265} \times 100 = 72
\]

5. To specify an ITR of 72 for system 1794, select the corresponding row in the ITR values list box. The ITR value moves down to the ITR value field under the list boxes.

6. Change this to 72.

7. Press Enter.

8. Select OK.


**Forecast reports**

These reports, which extrapolate information from historical data, analyze one application, one workload type, or one storage class. If you select more than one system, using Systems on the Parameters menu, Capacity Planner adds the figures from each system. For the processor power and DASD I/O throughput resources, Capacity Planner makes an adjustment for relative processing power before adding the figures.
To forecast the utilization of the combined batch workloads from systems 1692 and 1794 do the following:

1. Select the Parameters menu and Active workload type.
2. Select the batch workload.
3. Select OK.
4. Select the Reports menu, Forecasting, CPU utilization, and Workload type. The forecast shown in Figure 53 is displayed.

Capacity Planner has taken the figures for the batch workload on system 1692 and added the figures for the batch workload on system 1794 after adjusting for the different internal throughput rates and capture ratios.

For more information, see “Forecast using several systems” on page 97.

### Base month usage reports

Unlike the forecast reports, which have separate reports for each workload, base month usage reports report on all workloads or all defined applications for the selected systems.

This makes it easy to merge two systems—select the two systems and report on workload types. Do this for systems 1692 and 1794, and the report shown in Figure 54 will be displayed. As you can see, the result is an overloaded processor.
But suppose you want to see the effect of transferring just one workload to another system. To combine all the work on one system with one workload from another, you must define applications.

Here is an example where DB2 from system 1794 is transferred to system 1692:

1. Select the Parameters menu, Applications, and Define applications. The window shown in Figure 55 on page 81 is displayed.
2. Click on system 1692 in the Systems list box. The Applications list box is empty because no applications are defined.

3. Click Add. The Add Application window shown in Figure 56 is displayed.

4. Type all-1692 for the application name.

5. Click on all the performance groups in the Performance groups list box. This defines one application for system 1692 that comprises all the performance groups known to Performance Reporter for that system.
6. Click OK to save the definition.

7. Click system 1794 on the Define Application window. An empty Applications list box is displayed.

8. Click Add to get the Add Application window.

9. Type db2-1794 for the application name.

10. Click on the performance groups for DB2, which you can assume are 4 and 6 in this example. The performance groups are in the active IEAICSnn member of the MVS SYS1.PARMLIB data set.

11. Click OK to save the definition.

12. Click OK again to leave the Define Application window.

13. Select the Reports menu, Base month usage, and Applications. The report for all applications for the selected systems is displayed—that is, all-1692 and db2-1794.

This method works for the processor power, processor storage, and DASD I/O throughput resources. For DASD space, the figures for all storage classes are combined when you select more than one system. You cannot add VSAM space, for example, from system 1794 to the total of disk space for system 1692.

**Trend-and-Plan reports**

The same rules apply to trend-and-plan reports as to base month usage reports—figures for all defined applications or all workloads are added when you select more than one system. For DASD space, the figures for all storage classes are added.

For applications, workloads, and storage classes, you can set trend and plan values in the same way as for reports on a single system.
This chapter explains how Capacity Planner can add a detailed view of one OS/390 system, the reference system, to processor power data for other operating systems running in the same physical workstation.

The creation of a plan for one system is the first step in planning for a whole Processor Resource/System Manager or VM complex. Create a single-system plan as described in “Using Capacity Planner” on page 51. For an OS/390 system under VM, however, some SMF and RMF measurements can be misleading, especially when the OS/390 system is not the preferred guest workstation.

When you select a PR/SM or VM report, Capacity Planner combines a detailed single-system forecast with less detailed data for the other partitions or, in the case of VM, user classes running on the same workstation.

Figure 57 shows how Capacity Planner uses the CP_PROCCESSOR lookup table to build a PR/SM report. The only system selected on the Systems window is system 1692. Capacity Planner Feature Guide and Reference
PR/SM and VM

Planner looks at CP_PROCESSOR (downloaded as DRLPROC.DAT) and looks up the rows with MVS_SYSTEM_ID=1692. It finds three rows. VM_INDICATOR=0, so Capacity Planner knows that this is a PR/SM complex, not VM. One (and only one) of the rows has LPAR_INDICATOR=1. This row refers to the MVS system with an SMF ID of 1692. The other two rows refer to the other partitions in the same workstation.

For the reference MVS system, 1692, Capacity Planner uses its detailed information about the workload on that system. For the partitions D44H and D45F, Capacity Planner uses summarized information about each partition.

For a description of the lookup table CP_PROCESSOR, see “CP_PROCESSOR” on page 15.

To produce a trend-and-plan report for a PR/SM or VM complex do the following:

1. Select Processor power. PR/SM and VM reports are available only for this resource.
2. Specify only one system on the Systems window. This is the main MVS system running in the complex. If you use demonstration data, use system 1692 for a PR/SM report and system 2296 for a VM report, both with a base date of July 1994.
3. Specify trend and plan values for the workload types on this system, as for a single-system report.
4. Specify trend values for the other partitions (or, in the case of VM, user classes) in the complex. Do this selecting Trend values and Logical partitions on the Parameters menu. The Partition Trend Values window shown in Figure 58 is displayed.

![Partition Trend Values](image)

Figure 58. Specifying trend values for partitions

Remember that the growth is the percentage growth (which can be negative) in the planning interval. So do not enter an annual growth value if your planning interval is half a year.

The list box lists the partitions or user classes that share the same physical workstation with the reference MVS system. For each one, specify a trend value. For these systems, you cannot specify trend values at the workload level.
5. Select Trend and plan on the Reports menu. Select PR/SM or VM as appropriate. A report such as the one shown in Figure 59 is displayed.

When you select a PR/SM or VM report, Capacity Planner looks up the downloaded CP_PROCESSOR PR. lookup table. If the reference MVS system runs in a complex, Capacity Planner finds the names of the other partitions (or user classes) running on the complex, and extracts the data.

For the reference system, Capacity Planner uses its detailed data about workload types and their associated trend and plan values. For the other systems in the complex, Capacity Planner has only one figure for the utilization, because Capacity Planner does not know whether the system is OS/390 or some other operating system.

Combining systems in a complex

If you combine workload or application data from two systems, as described in "Combining Work from Several Systems" on page 77, be careful when both systems run on the same PR/SM or VM complex. In Figure 57 on page 83, for example, suppose partition D44H runs MVS. If you combine the MVS workload data for system D44H with the MVS data for the reference system D41B, a PR/SM report shows the processor load for partition D44H twice—once as MVS data combined with the reference system, and again as PR/SM data for partition D44H.

PR/SM processing

Capacity Planner can estimate the processing for the PR/SM code. This depends on the number of logical processors defined in the complex. When you are using the trend-and-plan report for a PR/SM complex, you can estimate the effect of changing the defined number of logical processors by selecting Configuration and Logical processors on the Parameters.
menu. When you have specified the number of logical processors, return to the trend-and-plan report, where the new overhead is shown.
## II — Reference

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Using a Keyboard

If you do not use a mouse, you can use these function keys:

**Capacity Planner Keys**

- **F2**: On the Open Profile window, display the profile description for the selected profile.
- **F3**: Leave and close the application.
- **Ctrl+Insert**: On the report window, copy the report to the clipboard.

These are standard OS/2 keys:

**Help keys**

- **F1**: Help information.
- **F2**: Extended help (within each help window).
- **Alt+F4**: Exit help.
- **F9**: Go to the key list (within each help window).
- **F11**: Go to the help index (within each help window).
- **Esc**: Previous help.
- **Alt+F6**: Switch between help and the program.
- **Shift+F10**: Help for help.

**System keys**

- **Alt+F6**: Switch to the next window.
- **Alt+Esc**: Switch to the next program, including full-screen programs.
- **Ctrl+Esc**: Switch to the task list.

**Window keys**

- **F3**: Close a window.
- **F10 or Alt**: Switch between the menu bar and the active window.
- **Arrow keys**: Move between choices.
- **End**: Go to the last pull-down choice.
Using a Keyboard

<table>
<thead>
<tr>
<th>Key Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esc</td>
<td>Close a pull-down or a system menu.</td>
</tr>
<tr>
<td>Home</td>
<td>Go to the first pull-down choice.</td>
</tr>
<tr>
<td>PgUp</td>
<td>Move up one page inside a window.</td>
</tr>
<tr>
<td>PgDn</td>
<td>Move down one page inside a window.</td>
</tr>
</tbody>
</table>

**Underlined letter**
- Select an action or pull-down choice.

**Alt+F4 or F3**
- Close a window.

**Alt+F5**
- Open a window.

**Alt+F7**
- Move a window.

**Alt+F8**
- Change the size of a window.

**Alt+F9**
- Minimize a window.

**Alt+F10**
- Maximize a window.

**Ctrl+PgDn or Shift+F8**
- Move the contents of a window one page to the right.

**Ctrl+PgUp or Shift+F7**
- Move the contents of a window one page to the left.

**Shift+Esc or Alt+Spacebar**
- Go to the system menu.

**Shift+Esc or Alt**
- Go to the system menu of a text window.
This chapter contains some of the help information that is also available online.

**Whether to plan by workload type or by application**

For the resources Processor power, Processor storage, and DASD I/O throughput, CPU utilization (in service units), storage usage, and I/Os are logged by performance group.

The lookup table CP_WORKLOAD_TYPE maps workload types to performance groups. So to report on workloads, you do nothing more in Capacity Planner—the definitions are downloaded to the workstation. But you may want to report on a performance group that was not defined as a separate performance group in the Performance Reporter lookup table. For example, suppose that VTAM and JES2 are grouped together as workload type SYSTEM, but have different performance groups. You can report on these separately by defining each as an application.

You can define an application as one or more performance groups in a system, but:

- You cannot include the same performance group in two or more application definitions.
- The performance groups must all be present in the CP_WORKLOAD_TYPE table—they must all be allocated to a workload type.

You get more flexibility with applications, but you have to define them. With a forecast report, you report on one defined application or one workload type. But you can define as many performance groups as you like as one application, so you can define ALL performance groups as one application, and the application forecast is effectively a forecast for the whole system.

With trend-and-plan reports, you report on all defined applications (for the selected systems) or all workload types (for the selected systems). With workload reports, you cannot, for example, report on all the workloads in SYS1 and CICS in SYS2, which might interest you if you are considering moving CICS from SYS2 to SYS1. But with an application trend-and-plan report, you can define just two applications, one for SYS1 with all performance groups (the whole system), and one for SYS2 with the performance group assigned to CICS. Reporting on all defined applications now gives you a report on SYS1 plus CICS from SYS2.
**Specifying capture ratios**

**Objective**

The objective is to calculate capture ratios for the base month.

**Steps**

1. Select Reports and Capture ratios. Look at the report. If the total utilization is within the limits of tolerance, use these capture ratio values. You can check them against the data from another month.
2. Select Parameters and Capture ratios.
3. If the total is below the limit of tolerance, one or more capture ratios are too high. Decrease some capture ratios. If the total is above the limit of tolerance, one or more capture ratios are too low. Increase some capture ratios.
4. Repeat steps 1 to 3 until the total utilization is within limits.

The default values are downloaded from the Performance Reporter lookup table CP_WORKLOAD_TYPE to the DRLCR.DAT file on the workstation. Typical capture ratios are in the range 50 to 90.

**Capture ratios for applications**

Select Capture ratios on the Parameters menu choice to specify a capture ratio for each workload type. Capacity Planner also uses these capture ratio values for application definitions, in this way:

1. It checks the first performance group defined for the application.
2. It finds out the workload type associated with this performance group, using the Performance Reporter lookup table CP_WORKLOAD_TYPE.
3. It uses the capture ratio for this workload type.

**Principles of forecast reports**

A forecast report uses your data up to and including the base month. It shows the best linear or exponential fit for the growth in usage of a single workload type, application, or DFSMS storage class.

To produce a forecast:

1. Select the resource.
   
   Forecasts for processor power and for DASD I/O throughput have the same result, because both forecast by extrapolating the processor power used.
2. Select the system and the base month.
3. You can only forecast for one workload type or application at one time (or, for DASD space, one storage class at a time). So use one of the following:
   - Active workload type.
   - Applications and Active application (you must define it first, though).
   - Active storage class (for a DASD space forecast).
4. Optionally, set the capture ratio for the workload.
5. Select Forecast type if you want an exponential forecast, rather than a linear forecast.

6. Select Reports and Forecasting. Capacity Planner can forecast by:
   - **CPU utilization** Choose this for workloads such as CICS and IMS.
   - **Users or jobs** Choose this for TSO and BATCH, where it helps to have the average utilization per MVS job and the number of jobs. This is the average number of jobs at any one time in the peak hours.

7. Then select Workload type to forecast usage for a defined workload type, or Application to forecast usage for your own selection of performance groups.

**Specifying plan values**

Plan values are steps in load. You can specify them for all resources:

- **Processor power** By application or workload type.
- **Processor storage** By application or workload type.
- **DASD I/O throughput** By application or workload type—these values are the same as those for processor power, because Capacity Planner assumes that the growth is proportional.
- **DASD space** By DFSMS storage class.

To specify plan values, do the following:

1. Check the base month and the planning interval, which define the intervals for the plan values. For example, if your base month is November 1994 and the planning interval is six months, specify the plan values for the first six months (Dec 1994 to May 1995) and for the second six months (Jun 1995 to Nov 1995).

2. Select Parameters and Plan values.

3. On the Workload Planning or Application Planning windows, select the workload (or application) and interval. Then, select Define to specify the plan value.

4. Select Reports and Trend and plan to display the report.

5. Select Reports, Trend and plan, and Plan values to display a summary of your plan values.

You can specify plan values for the MVS reference system, but you can only specify general trend values for partitions and VM user classes.
Example of planning for I/O throughput

Example

You have an MVS system. The MVS system is called SYS1. You think that the use of DB2 will grow by 50% in the year. It is now September 1994 and you have a full set of data for August 1994.

Objective

The objective is to estimate the effect of DB2 growth on I/O throughput, and to calculate a DASD configuration to handle the increased throughput.

Steps

1. Select the DASD I/O throughput resource.
2. Select Parameters and Systems.
3. Select SYS1.
5. Set the base month to August 1994.
6. Optionally, adjust the capture ratios as described in “Specifying capture ratios” on page 92.
7. Select Planning interval and choose an interval of one year.
8. Make a forecast, as described in “Principles of forecast reports” on page 92, to estimate the growth for all workloads except DB2.
9. Select Trend values (for workloads) and specify the growth values from the forecast reports, except for DB2, where you enter 50.
10. Select a trend-and-plan report, by workload type.
11. When you redisplay the report, the total I/O throughput required by August 1995 is displayed. Now use the configuration report to build a configuration that can handle this.
12. Select Parameters, Configuration, and I/O throughput. Specify your DASD configuration in terms of basic configurable units (BCUs).
13. Select Reports, DASD Configuration, and I/O throughput. See whether the I/O throughput meets the total required by the plan.
14. If not, return to Parameters and add more BCUs until the configuration can handle the increased throughput.
Example of planning for disk space

Example

You have an MVS system. The MVS system is called SYS1. You think that VSAM space will grow by 50% in the next quarter, and that NONSMS space will decrease by 20% in the same period. It is now September 1994 and you have a full set of data for August 1994.

Objective

The objective is to estimate the disk space requirement for the next quarter, and to calculate a DASD configuration that has this capacity.

Steps

1. Select the DASD space resource.
2. Select Parameters and Systems.
3. Select SYS1.
5. Set the base month to August 1994.
6. Select Planning interval and choose an interval of one quarter.
7. Make a forecast, as described in “Principles of forecast reports” on page 92, to estimate the growth for all storage classes except NONSMS and VSAM.
8. Select Trend values and Storage classes, and specify the growth values from the forecast reports, except for VSAM, where you enter 50, and NONSMS, where you enter −20.
9. Select Reports, Trend and plan, and Storage classes. The total disk space required by November 1994 is displayed. Now use the configuration report to build a configuration that has this space.
10. Select Parameters, Configuration, and DASD space.
11. Specify your current DASD configuration. For DASD space, specify the number of DASD units (boxes) rather than the number of logical addresses (actuators).
12. Select Reports, DASD Configuration, and DASD space. See whether the DASD space meets the total required by the plan.
13. If not, return to Parameters and add more units until the configuration has the necessary space.

Seeing the effect of changing processor storage

Example

You have an MVS system called SYS1. It is now September 1994 and you have a full set of data for August 1994.

Objective

The objective is to estimate the effect of increased storage on paging and page movement rates.
Steps
1. Select the Processor storage resource.
2. Select SYS1 on the Systems window.
3. Set the base month to August 1994, the last month for which you have full data, on the Time reference window.
4. Select Configuration and Processor storage to make changes to central storage. As a rule of thumb, increase central storage until the page movement rate is below 500 pages a second.
5. Select Storage adjustment reports from the Reports menu. Select the page movement rate. Check the paging rate report and increase the expanded storage until the paging rate is nearly zero.

Seeing the effect of a faster processor

Example
You have an MVS system called SYS1. It is now September 1994 and you have a full set of data for August 1994.

Objective
The objective is to see what effect the processor upgrade will have.

Steps
1. Select the resource type Processor power.
2. Select SYS1 on the Systems window and make this the reference system.
4. Optionally, set capture ratios for the SYS1 workload types.
5. Specify trend and plan values for the workload types in SYS1.
6. Select Reports, Trend and plan, and Workload types.
7. Select Parameters, Configuration, and Processor power.
8. Set the new processor power. Change it from 100 (always the relative power of the installed processor) to 130. Note the effect on the report.
Forecast using several systems

Example

You have two MVS systems called SYS1 and SYS2. In SYS1, CICS is in performance group 4. In SYS2, CICS is in performance group 5. SYS1 runs on a workstation that has twice as much processing power as the workstation running SYS2.

Objective

The objective is to forecast the combined load of both CICS systems on the processor running SYS1. The forecast uses only data up to and including the base month. It does not consider plan and trend values.

Steps

1. Select Parameters and Systems.
2. Select SYS1 and give it a relative internal throughput rate (ITR) of 100.
3. Select SYS2 and give it a relative ITR of 50.
4. Make SYS1 the reference system.
5. Set the base month to the last month for which you have full data, on the Time reference window.
6. Select Parameters, Applications, and Define applications.
7. Select SYS1 and define the CICS application with performance group 4.
8. Select SYS2 and define an application also called CICS but with performance group 5.
9. Select Applications and Active application and select the CICS application.
10. Select Reports, Forecasting, CPU utilization, and Application.

Example of using PR/SM reports

Example

You have an MVS system running in a partitioned processor. The MVS system is called SYS1. It is now September 1994 and you have a full set of data for August 1994.

Objective

The objective is to see when the processor will run out of capacity.

Steps

1. Select the Processor power resource.
2. Select Parameters and Systems.
3. Select SYS1 and make it the reference system. Capacity Planner uses this name as a key to the Performance Reporter lookup table CP_PROCESSOR, downloaded with the data, which maps the MVS system to the partitions that run on the same physical processor.
5. Set the base month to August 1994.
6. Optionally, set capture ratios for the SYS1 workload types. Capacity Planner considers planned growth in the reference system workload types, but for the other partitions it just uses a single trend value.

7. Select Trend values and Logical partitions, and specify a value for each partition. You cannot specify a trend value for the reference system, so it is not included in the list of systems. Remember that the trend value is the expected percentage change for each planning interval.

8. For the reference system, SYS1, set trend and plan values for each workload type.

9. Select Reports, Trend and plan, and PR/SM complex. The trend-and-plan report shows the PR/SM overhead as a percentage. You can estimate the increased overhead of extra logical processors by selecting Logical processors on the Parameters menu.

Example of using VM reports

Example

You have an MVS system running in a virtual machine under VM. The MVS system is called SYS1. It is now September 1994 and you have a full set of data for August 1994.

Objective

The objective is to see when the processor will run out of capacity.

Steps

1. Select the Processor power resource.
2. Select Parameters and Systems.
3. Select SYS1 and make it the reference system. Capacity Planner uses this name as a key to the Performance Reporter lookup table CP_PROCESSOR, downloaded to the workstation DRLPROC.DAT file. DRLPROC.DAT maps the MVS system to the virtual machines that run on the same physical processor. (The mapping is really not to individual virtual machines but to user classes, groups of virtual machines defined to VMPRF).
5. Optionally, set capture ratios for the SYS1 workload types. Capacity Planner considers planned growth in the reference system workload types, but for the other user classes, it just uses a single trend value.
6. Select Trend values and Logical partitions, entering a value for each user class except the reference system. Remember that the trend value is the expected percentage change for each planning interval.
7. For the reference system, SYS1, set trend and plan values for each workload type.
8. Select Reports, Trend and plan, and VM complex.
This table is DASDTAB.DAT. It is downloaded to your workstation with the Capacity Planner executable files and is in the working directory.

It gives the maximum expected I/O rate (I/Os per second) for a given response time (in milliseconds) and DASD type. The c suffix on the DASD type denotes a cache. The I/O rate is for a basic configurable unit (BCU), which is the unit of DASD described in “Planning for DASD I/O throughput” on page 38, not an actuator or physical unit.

The I/O rates for each response time are determined by experiment. The throughput for a given response time may be different at your installation. Use the MVSPM_DEVICE_H table, which is part of the OS/390 performance management component of the System Performance feature, to find the response times and throughput of your DASD devices.

You can edit this table with a text editor for example, to define other types of DASD. The maximum number of BCU types is 40.

<table>
<thead>
<tr>
<th>BCU type</th>
<th>Required response time in ms</th>
<th>I/O rate in I/Os per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>3380A</td>
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<td>BCU type</td>
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<td>I/O rate in I/Os per second</td>
</tr>
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<td>Required response time in ms</td>
<td>I/O rate in I/Os per second</td>
</tr>
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<tr>
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<td>444</td>
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</table>
This table is DASDGB.DAT. It is installed in the working directory.

It gives the space available for each type of DASD. You can edit this table with a text editor for example, to define other types of DASD. The maximum number of DASD types is 40.

<table>
<thead>
<tr>
<th>DASD type</th>
<th>Space in GB</th>
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<tbody>
<tr>
<td>3380A</td>
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</tr>
<tr>
<td>3380D</td>
<td>2.52</td>
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<tr>
<td>3380E</td>
<td>5.04</td>
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<tr>
<td>3380J</td>
<td>2.52</td>
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<tr>
<td>3380K</td>
<td>7.56</td>
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<tr>
<td>33901</td>
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<tr>
<td>33902</td>
<td>22.70</td>
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<tr>
<td>33903</td>
<td>34.00</td>
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</tbody>
</table>
This chapter shows some of the calculations that Capacity Planner uses to produce its reports. Some of the calculations are performed as a part of the normal Performance Reporter table and report processing, under OS/390. Other calculations are performed on the workstation.

**Summarization by peak hour**

Your installation must have enough capacity for peak usage, not just enough capacity to cope with the average load. That is why Capacity Planner uses data from the peak hours. Specify your peak hours in the PERIOD_PLAN control table. The administrator normally does this when customizing Capacity Planner for Performance Reporter. To change a control table, use the administration dialog. Capacity Planner calculates the average values for each peak hour by adding the values for each peak hour for each working day and dividing this total by the number of peak hours in the month.

**Users and jobs**

Some reports give the usage by user or job. Here, a user is a user who has sole use of an OS/390 job, such as a TSO user. A CICS or IMS user, on the other hand, shares one MVS job with many other users, so Capacity Planner cannot calculate the load per CICS or IMS user.

**Total processor usage by RMF interval**

This calculation is used for each RMF interval, when OS/390 is not running under PR/SM.

\[ \text{TOTCPU} = \frac{100 - \text{CPUWAIT}}{100} \times \text{INT} \times \text{NRCP} \]

where:

- **TOTCPU**: Processor time, in seconds, from SMF type-70 record
- **CPUWAIT**: Processor wait time, in percent
- **INT**: RMF interval, in seconds
- **NRCP**: Number of processors in the physical processor
Processor usage by workload type

Capacity Planner uses SMF type-72 records. The processor time for each workload type for each RMF interval is calculated with the following formula.

\[ \text{WKLnCPU} = \frac{\text{TCBSUn}}{\text{CPU}} + \frac{\text{SRBSUn}}{\text{SRB}} \]

where:
- \( \text{WKLnCPU} \) is the processor time for workload \( n \) in seconds.
- \( \text{TCBSUn} \) is the processor (TCB) service units for workload \( n \) from SMF type-72 record.
- \( \text{SRBSUn} \) is the SRB service units for workload \( n \) from SMF type-72 record.
- \( \text{CPU} \) is the processor-service-definition coefficient SMF72CSD from the SMF type-72 record.
- \( \text{SRB} \) is the SRB-service-definition coefficient SMF72SSD from the SMF type-72 record.
- \( \text{SRM} \) is the SRM constants for the processor SRMCONST from the parameter table CP_PROCESSOR.

The percentage workload processor load is calculated by the following formula.

\[ \text{WKLUn} = \frac{\text{WKLnCPU} \times 100}{\text{INT}} \]

where:
- \( \text{WKLUn} \) is the processor load for the workload, in percent.
- \( \text{WKLnCPU} \) is the average processor time for the workload, in seconds.
- \( \text{INT} \) is the RMF interval, in seconds.

Calculating the capture ratio

The total processor time has three parts:
1. Task control block (TCB) time
2. Service request block (SRB) time
3. Uncaptured time.

Uncaptured time is shared between users, but not equally. The proportion of uncaptured time is more for some workloads than for others.

The following formula defines the capture ratio as the total service time divided by the total processor time. This capture ratio is a measure of the system overhead.

\[ \text{CR} = \frac{\text{TCB + SRB}}{\text{TOTCPU}} \]

where:
- \( \text{CR} \) is the capture ratio.
- \( \text{TCB} \) is the TCB time, in seconds.
When the capture ratios are different for each workload, you get the following formula:

\[
\frac{WKL1CPU}{CR1} + \frac{WKL2CPU}{CR2} + \ldots + \frac{WKL7CPU}{CR7} = TOTCPU
\]

where:

- \(WKLnCPU\): CPU time for workload \(n\), in seconds \((n=1, \ldots, 7)\)
- \(CRn\): Capture ratio for workload \(n\) \((n=1, \ldots, 7)\)
- \(TOTCPU\): Total processor time, in seconds

The capture ratios report uses the previous formula. You adjust the capture ratios until the calculated total processor time equals the observed total processor time for as many intervals as possible.

Table 11 shows a typical range of capture ratios and the best fit from a sample installation.

<table>
<thead>
<tr>
<th>Workload type</th>
<th>Capture ratio range</th>
<th>Best fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATCH</td>
<td>0.88 — 0.92</td>
<td>0.91</td>
</tr>
<tr>
<td>CICS</td>
<td>0.91 — 0.98</td>
<td>0.93</td>
</tr>
<tr>
<td>IMS</td>
<td>0.75 — 0.86</td>
<td>0.78</td>
</tr>
<tr>
<td>TSO</td>
<td>0.79 — 0.90</td>
<td>0.85</td>
</tr>
<tr>
<td>STC</td>
<td>0.59 — 0.70</td>
<td>0.60</td>
</tr>
<tr>
<td>DB2</td>
<td>0.58 — 0.70</td>
<td>0.65</td>
</tr>
<tr>
<td>DEMO</td>
<td>0.87 — 0.92</td>
<td>0.91</td>
</tr>
</tbody>
</table>

The more processor time the workload uses, the more accurate the calculation of the capture ratio. Breaking up workloads into smaller units reduces the accuracy of the calculation.

Check your capture ratios when you change your workloads and your OS/390 system. The ratios also vary with processor load—they are usually smaller when the workstation is overloaded.

When you have checked the capture ratios on the workstation, consider updating the lookup table CP_WORKLOAD_TYPE, which has the default values.

**PR/SM processing**

Processor Resource/System Manager (PR/SM) shares a physical processor between several partitions, which can run OS/390 and other operating systems.

Processor power is shared dynamically between the partitions, but the central storage and expanded storage are statically divided. When the systems run, each gets a share of the processor according to how much it needs, but its share of storage is fixed.
The PR/SM microcode dispatches the various partitions. One or more processors can be dedicated to a partition or shared between several. If dedicated, the named processors work only for that partition. If shared, the processor works for each partition according to its weighting. The number of logical processors for a given partition is the sum of the number of dedicated and shared processors. The total number of logical processors in the workstation is the sum of the number of logical processors for each partition. The PR/SM processing, which reduces the workstation internal throughput rate (ITR), depends on the total number of logical processors. The following formula gives the approximate overhead due to PR/SM, although this in practice depends on the PR/SM microcode level.

\[ \text{OVERHEAD}_{-}\text{PRSM} = \text{NLPROC} \times \left( \frac{\text{NLPROC}^2}{\text{NPROC} \times \text{NLPAR}} \right) \]

where:
- \( \text{OVERHEAD}_{-}\text{PRSM} \) = PR/SM overhead
- \( \text{NLPROC} \) = Number of logical processors (LOGICAL_PROC)
- \( \text{NPROC} \) = Number of physical processors from CP_PROCESSOR
- \( \text{NLPAR} \) = Number of partitions from CP_PROCESSOR

The overhead is displayed on the trend-and-plan report for a PR/SM system. Specify NLPROC, the number of logical processors, by selecting Configuration and Logical processors on the Parameters menu.

The load of the physical workstation is the sum of the loads for each partition. The overhead is also added, to make apparent by how much the PR/SM overhead reduces the capacity of the workstation.

**Storage requirement by workload type**

Capacity Planner gets storage data for each workload from SMF type-79 records. Refer to *SLR Capacity Planner Installation Guide* for instructions on starting RMF Monitor II. Capacity Planner calculates the storage requirements from the average use of central storage and expanded storage for each workload type.

**System area storage**

RMF Monitor I gives information about storage usage in its paging activity report. RMF prints or displays SMF type-71 records.

The system storage is the sum of the storage for the system address spaces and the system areas:
- Nucleus
- SQA
- CSA
- HSA.

Capacity Planner assigns this to SYS-AREA.
Variation of paging rate with storage

The demand paging rate is the number of pages loaded from the page data set into central storage each second (the page-in rate) added to the number of pages written from central storage to the page data set each second (the page-out rate). The following formula shows the approximate relationship between processor storage and the paging rate. The storage adjustment report uses this formula.

\[ \text{PAGRAT} \times (\text{ES} + \text{CS})^2 = \text{constant} \]

where:
- \( \text{PAGRAT} \) Paging rate (pages/second)
- \( \text{CS} \) Central storage (MB)
- \( \text{ES} \) Expanded storage (MB)

The page-in rate comes from the field SMF71PIN, and the page-out rate comes from the field SMF71POT. Both fields are in the SMF type-71 record.

A lower paging rate reduces I/O operations and improves response.

Variation of page movement rate with storage

The page movement rate is the number of pages per second read from and written to expanded storage. The following formula shows the approximate relationship between processor storage and page movement. The storage adjustment report uses this formula.

\[ \text{PAGMOV RAT} \times (\text{CS})^2 = \text{constant} \]

where:
- \( \text{PAGMOV RAT} \) Page movement rate (pages/second)
- \( \text{CS} \) Central storage (MB)

The number of pages moved to expanded storage comes from the field SMF71PES, and the number of pages read from expanded storage comes from SMF71RES. Both fields are in the SMF type-71 record.

The greater the page movement rate, the more processor time is used to manage the paging to expanded storage. This processor usage is collected into performance group 0. These calculations help predict how increased processor storage reduces paging to DASD and to expanded storage. You can also use them to optimize the sharing of storage in a PR/SM environment.

I/O throughput by workload type

Capacity Planner determines the I/O rate for each workload type by adding the values for the different performance groups. The I/O activity for each performance group is the EXCP count in the SMF type-30 records.

Capacity Planner uses the average EXCP count for each workload type for each hour and then calculates the relative I/O content (RIOC) using the following formula.
Calculations

\[ R = \frac{S}{M \times B} \]

where:
- \( R \) Relative I/O content (RIOC)
- \( S \) I/O rate (EXCPs per second)
- \( M \) Relative processor power
- \( B \) Fraction of processor used \((0 < B < 1)\)
- \( M \times B \) Processor power used by the workload

**Determining the I/O rate from the processor usage**

The following formula calculates the I/O rate for a predicted processor usage and a known RIOC. Trend-and-plan reports for DASD I/O throughput use this formula.

\[ S = M \times R \times B \]

where:
- \( S \) I/O rate (EXCPs per second)
- \( R \) Relative I/O content (RIOC)
- \( M \) Relative processor power
- \( B \) Fraction of processor used \((0 < B < 1)\)
- \( M \times B \) Processor power used by the workload

You estimate trend and plan values as for processor power. The new I/O rate is the processor power used by the workload multiplied by the relative I/O content (RIOC).

**Comparing start I/Os and EXCPs**

For the sequential access methods BSAM, QSAM, and BPAM, the EXCP count is incremented at end-of-block. Because there can be several blocks for each start I/O (SIO), the EXCP count can be higher than the SIO count. For the other access methods, the two are equal.

Although the EXCP count may be higher than the number of SIOS, the difference is insignificant for capacity planning purposes.

To check the relationship between SIOS and EXCPs, examine the SIO rate at the disk level using SMF type-74 records or the corresponding table (MVSPM_DEVICE_H). Compare this table with the tables based on EXCPs, such as MVS_ADDRSPACE_M. This eliminates the page and spool disks.
This chapter shows you where Capacity Planner gets the data for its analysis. Do not change the format of any Capacity Planner tables. The Capacity Planner tables contain data only from the peak hours defined in the PERIOD_PLAN control table.

**Processor power and I/O throughput**

These are the sources of data for processor power and I/O throughput reports.

<table>
<thead>
<tr>
<th>Data</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum and average CPU load</td>
<td>CP_CPU_M \newline PERIOD_PLAN \newline SMF type-70 records</td>
</tr>
<tr>
<td>Average service unit rate and utilization, by workload and performance group</td>
<td>CP_WKLOAD_M \newline PERIOD_PLAN \newline CP_WORKLOAD_TYPE \newline SMF type 72-1 records, fields: SMF72CTS \newline SMF72CSD \newline SMF72STS \newline SMF72SSD \newline SMF72INT</td>
</tr>
<tr>
<td>Average start-I/O (SIO) rate, by workload and performance group</td>
<td>CP_JOB_M \newline CP_TIME_M \newline PERIOD_PLAN \newline CP_WORKLOAD_TYPE \newline SMF type-30 subtype 2 and 3, field: SMF30TEP</td>
</tr>
<tr>
<td>Average number of jobs in the peak period, by workload and performance group</td>
<td>CP_JOB_M \newline CP_TIME_M \newline PERIOD_PLAN \newline CP_WORKLOAD_TYPE \newline SMF type-30 subtype 2 and 3 records</td>
</tr>
<tr>
<td>Average logical partition load</td>
<td>CP_LPAR_M \newline PERIOD_PLAN \newline SMF type-70 records</td>
</tr>
<tr>
<td>Average processor utilization for VM user classes</td>
<td>CP_VMPRF02_M \newline CP_VMPRF41_M \newline PERIOD_PLAN \newline VMPRF type 41-S and type 2-S records</td>
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</table>
Processor storage

These are the sources of data for processor storage reports.

<table>
<thead>
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<th>Data</th>
<th>Source</th>
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<td>SMF71POT</td>
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<td>SMF71INT</td>
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<td>Page movement rate</td>
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<td>PERIOD_PLAN</td>
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DASD space

These are the sources of data for DASD space reports.

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### Downloaded lookup tables

These tables are downloaded to the workstation.

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The Capacity Planner dialog follows the Common User Access 1991 guidelines for Presentation Manager applications, with these exceptions:

- The content of the main object (the active profile) is never displayed—only the name of the active object is displayed.
- Apply, Reset, and Cancel push buttons are not used in some dialog boxes.
III — Appendixes
List of Abbreviations

These abbreviations appear in this book:

BCU  basic configurable unit
BPAM  basic partitioned access method
BSAM  basic sequential access method
CD-ROM  compact disk—read-only memory
CICS  Customer Information and Control System
DB2  DATABASE 2
DFSMS  data facility storage management subsystem
DIM  data in memory
EXCP  execute channel program
IMS  Information Management System
I/O  input/output
ISPF  Interactive System Productivity Facility
ITR  internal throughput rate
LPAR  logically partitioned mode
NPM  NetView Performance Monitor
PR/SM  Processor Resource/System Manager
QSAM  queued sequential access method
RIOC  relative I/O content
RMF  Resource Management Facility
SIO  start I/O
SMF  system management facilities
SMP/E  System Modification Program/Extended
SQL  Structured Query Language
SRB  service control block
TCB  task control block
TSO  Time Sharing Option
VSAM  Virtual Storage Access Method
A

actuator
An independently addressable part of a disk drive.

administration
A Performance Reporter task that includes maintaining the database, updating environment information, and ensuring the accuracy of data collected.

administration dialog
The set of host windows used to administer Performance Reporter.

application
An application is the name that you give to one or more performance groups on the system. Unlike workload types, which you define to the lookup table CP_WORKLOAD_TYPE, you define applications only to the Capacity Planner workstation dialog.

B

base month
For base month usage and storage adjustment reports, this is the month of data that is used in the report. For forecast and trend-and-plan reports, this is the last month of historical data used in the report—the month at which the forecast starts.

basic configurable unit
A logical unit of DASD hardware consisting of a pair of DASD strings. A 3880 normally controls one BCU, and a 3990 normally controls two BCUs (four strings). A BCU can have variable DASD space, because the number of devices on each string is not specified. It is useful to specify a DASD configuration in terms of BCUs when you are planning for I/O throughput.

C

cache
Storage in the DASD controller where recently accessed blocks are buffered.

capture ratio
The proportion of a workload that is measurable. For example, if statistics show that TSO uses 40% of a processor, and the TSO capture ratio is 80%, TSO really uses 50% of the processor. MVS statistics show some processor utilization that is not allocated to any workload. This unallocated work must be shared between the workloads according to their capture ratios. Default capture ratios for each workload are held in the lookup table CP_WORKLOAD_TYPE, which is downloaded to the DRLCR.DAT workstation file, but the values in the profile override the default values.

central storage
Storage directly addressable by programs running in a processor.

COLLECT
A process used by Performance Reporter to read data from input log data sets, interpret records in the data set, and store the data in DB2 tables in the Performance Reporter database.

component
An optionally installable part of a Performance Reporter feature.

control table
A predefined Performance Reporter table that controls results returned by some log collector functions.
data in memory
A number of techniques, such as the virtual lookaside facility, for using expanded storage in an MVS/ESA environment.

data table
A Performance Reporter table that contains performance data used to create reports.

DCOLLECT
An MVS/DFP IDCAMS command that gathers information about disk space allocation. Performance Reporter collects the output of this command, and the data is used in disk space planning.

distributed transaction processing
The distribution of processing among transactions that communicate synchronously with each other over intersystem or interregion links.

environment information
All of the information that is added to the log data to create reports. This information can include data such as performance groups, shift periods, installation definitions, and so on.

Execute Channel Program (EXCP)
This routine initiates data transfer to or from DASD. It is higher level than start-I/O, though not as high-level as the access methods QSAM and VSAM.

expanded storage
Storage used for paging and data spaces. It is faster than disk, but slower than central storage.

forecast
In Capacity Planner, a forecast is a linear or an exponential extrapolation of historical data up to the base month. When forecasting by processor utilization, or by the average number of users or jobs, or by processor storage, a single selected application or workload type is used. When forecasting by DASD space, a single storage class is used.

help topics
An online table of contents for the Performance Reporter online help information.

internal throughput rate
A measure of the relative power (capacity) of a processor.

key columns
The columns of a DB2 table that together constitute the key.

key value
Value used to sort records into groups.

log
Any sequential data set used as input to Performance Reporter.
**log collector**
A Performance Reporter program that processes log data sets and provides other Performance Reporter services.

**log collector language**
Performance Reporter statements used to supply definitions to and invoke services of the log collector.

**log data set**
Any sequential data set used as input to Performance Reporter.

**log definition**
The description of a log data set processed by the log collector.

**log procedure**
A program module that is used to process all record types in certain log data sets.

**logical unit (LU)**
A port through which a user gains access to the services of a network.

**logically partitioned mode (LPAR)**
When a processor runs in this mode, it can be used as a PR/SM complex, where several systems can run at the same time.

**lookup expression**
An expression that specifies how a value is obtained from a lookup table.

**lookup table**
A Performance Reporter DB2 table that contains grouping, translation, or substitution information.

**metafile**
A standard format for saving a graphic picture on a workstation.

**migration age**
A measure of expanded storage usage. The smaller the number, the more there is a shortage of expanded storage.

**N**

**N-way value**
In a PR/SM system, the average number of logical processors for each partition.

**object**
An integral part of a feature component needed for data collection (for example, record definitions, record procedures, and update definitions).

**P**

**page movement rate**
The rate of movement of pages between central and expanded storage.

**paging rate**
The rate of movement of pages between storage (both central and expanded) and disk. As used in Capacity Planner, this excludes swapping, and is the same as the demand paging rate.

**partition**
One of the logical machines in a PR/SM machine. A partition can have the use of one or more processors.

**performance group**
A number that tells MVS how to treat an application for performance purposes.
Performance Reporter database
A set of DB2 tables that includes data tables, lookup tables, system tables, and control tables.

planning interval
The smallest unit of time used in a forecast. It can be one month, a quarter, half a year, or a year.
You normally set this once, directly after creating a profile. Be careful about changing it later—this invalidates
trend and plan data.

plan value
A planned change in load. For example, a new application going into production will have an effect on the
forecast. Because this extra load cannot be predicted from historical values, it must be quantified (an intelligent
guess) and added to the capacity plan.

processor-busy-second
The amount of work done by a processor in one second, if 100% busy, or the amount of work done in two
seconds if 50% busy.

profile
The workstation file containing the capacity planning parameters that you specify when you use the dialog. You
write to this file when you select Save or Save as on the File action of the main window.

Processor Resource/System Manager (PR/SM)
A system of dividing a machine into several independent logical machines.

purge condition
Instruction for purging unneeded data from the Performance Reporter database.

record definition
The description of a record type contained in the log data sets used by Performance Reporter, including detailed
record layout and data formats.

record procedure
A program module that is called to process some types of log records.

record type
The classification of records in a log data set.

region
A section of the dynamic area that is allocated to a job step or system task.

relative I/O content
A measure of how I/O intensive an application is.

report definition language
Performance Reporter statements used to define reports and report groups.

report group
A collection of Performance Reporter reports that can be referred to by a single name.

reporting dialog
A set of host or workstation windows used to request reports.

resource
Any facility of the computing system or operating system required by a job or task, including central storage,
input/output devices, the processing unit, data sets, and control or processing programs.

resource group
A collection of resources identified as belonging to a particular department or division. Resources are organized
into groups to reflect the structure of an organization.

resource information
Environment information that describes the elements in a system (for example, a network).
section
A structure within a record that contains one or more fields and may contain other sections.

service request block
An MVS control block that is not owned by any application, but is used when work is done by MVS on behalf of an application.

source
In an update definition, the record or DB2 table that contains the data used to update a Performance Reporter DB2 table.

start I/O
A machine instruction that initiates data transfer to or from DASD.

storage class
DFSMS uses storage classes to group disk by performance criteria.

subcomponent
An optionally installable part of a Performance Reporter feature component.

system table
A DB2 table that stores information for controlling log collector processing, Performance Reporter dialogs, and reporting.

target
In an update definition, the DB2 table in which Performance Reporter stores data from the source record or table.

task control block
The main control block for an MVS task.

threshold
The maximum or minimum acceptable level of usage. Usage measurements are compared with threshold levels.

trend value
A measure of the rate of change of a variable, based on past values or input values. The value can be positive or negative, and is the percentage increase or decrease in the planning interval. For example, if the planning interval is 6 months, a trend value of 1% means that the expected growth of a resource is 1% each 6 months after the base month.

update definition
Instructions for entering data into DB2 tables from records of different types or from other DB2 tables.

unreferenced interval count
The highest number of intervals that a page is not referenced before it is marked for paging out. On a system with no storage constraints, this is 255, the maximum value.

updates
Instructions in Performance Reporter on how to process data from log data sets to DB2 tables.

user class
VM uses user classes to group its virtual machines. The lookup table CP.PROCESSOR, which is downloaded to the DRLPROC.DAT workstation file, maps user classes to the MVS systems running in virtual machines.
view
An alternative representation of data from one or more tables. A view can include all or some of the columns contained in the table on which it is defined.

virtual lookaside facility
A feature of MVS/ESA that lets programs make use of expanded storage.

VM
A hypervisor operating system. Operating systems such as MVS, and VM itself, can run under this operating system. Capacity Planner can analyze data from VM/ESA and from VM/XA.

workload
The work done by a machine on behalf of a group of applications.

workload type
A set of performance groups to be considered as a single load on the machine. For example, TSO. Workloads are defined in the lookup table MVS_WORKLOAD_TYPE, which is downloaded to the DRLCR.DAT workstation file.
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